Scientific and Technical Aerospace Reports

STAR

Volume 37
November 22, 1999

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Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. For related information, see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance*. For space suits, see *54 Man/System Technology and Life Support*.

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18   Spacecraft Design, Testing and Performance   49

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Typical Report Citation and Abstract

❶ 19970001126 NASA Langley Research Center, Hampton, VA USA

❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**

❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;

❹ Mar. 1996; 130p; In English

❺ Contract(s)/Grant(s): RTOP 505-68-70-04

❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

❼   To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10' to 50', and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65' swept forebody serrations tended to roll together, while vortices from 40' swept serrations were more effective in generating additional lift caused by their more independent nature.

❽ Author

❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
2. Title
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SCIENTIFIC AND TECHNICAL AEROSPACE REPORTS

A Biweekly Publication of the National Aeronautics and Space Administration

01
AERONAUTICS (GENERAL)

19990101884 Royal Aeronautical Society, London, UK
The Aeronautical Journal, Volume 102
Stollery, John, Editor, Royal Aeronautical Society, UK; The Aeronautical Journal Volume 102 Number 1011 January 1998; Jan. 1998; ISSN 0001-9240; 63p; In English; See also 19990101885 through 19990101891; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

  This issue contains a variety of articles about aeronautics, aircraft design, and other studies. The articles are titled: (1) Identification of non-linear derivative models from Bo 105 flight test data, (2) On the equations of motion for an aircraft with an internal moving load which is then dropped, (3) Two new techniques for aircraft parameter estimation using neural networks, (4) Variable cycle jet engines for a Mach 2.7 supersonic civil transport, (5) Experiments on cruise jet propulsion with a hydrogen scramjet, (6) Studies into hail ingestion of turbofan engines using a rotating fan and spinner assembly, and (7) Combined erect of wall suction and ribblets on a low R(sub theta) turbulent boundary layer.
CASI
Aircraft Design; Flight Tests; Aeronautics; Aeronautical Engineering; Aerodynamics; Avionics

19990104600 Logistics Management Inst., McLean, VA USA
A System for Integrated Reliability and Safety Analyses *Final Report*
Kostiuk, Peter, Logistics Management Inst., USA; Shapiro, Gerald, Logistics Management Inst., USA; Hanson, Dave, Draper (Charles Stark) Lab., Inc., USA; Kolitz, Stephan, Draper (Charles Stark) Lab., Inc., USA; Leong, Frank, Draper (Charles Stark) Lab., Inc., USA; Rosch, Gene, Draper (Charles Stark) Lab., Inc., USA; Coumeri, Marc, Draper (Charles Stark) Lab., Inc., USA; Scheidler, Peter, Jr., Draper (Charles Stark) Lab., Inc., USA; Bonesteel, Charles, CHAVA Group, USA; August 1999; 90p; In English
Contract(s)/Grant(s): NAS2-14361; RTOP 536-16-11-01
Report No.(s): NASA/CR-1999-209548; NS805S1; NAS 1.26:209548; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

  We present an integrated reliability and aviation safety analysis tool. The reliability models for selected infrastructure components of the air traffic control system are described. The results of this model are used to evaluate the likelihood of seeing outcomes predicted by simulations with failures injected. We discuss the design of the simulation model, and the user interface to the integrated toolset.
Author
Reliability Analysis; Aircraft Safety; Air Traffic Control; Computerized Simulation; Failure Modes; Systems Integration; Systems Analysis

19990104603 Air Command and Staff Coll., Maxwell AFB, AL USA
Air Force Aircraft Maintenance Outsourcing and Privatization: A Bonanza or A Bust?
Mellott, Lionel S.; Apr. 1998; 43p; In English
Report No.(s): AD-A367210; ACSC-194-1998-04; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

  The increased use of outsourcing and privatization (O&P) represents a fundamental change in how the USAF does business in fulfilling its role of ensuring the Nation's security. A decreasing USAF budget and manpower without corresponding decrease in operations tempo has forced the USAF to find innovative methods to accomplish its mission and save scarce dollars for modern-

ization programs. The lengthy procurement process for major new weapon systems demand the Air Force invest now force modernization so a capable USAF will exist in the future. Properly executed O&P initiatives saves manpower and dollars, and enables the Air Force to focus its dwindling budget on supporting the warfighter. In Chapter 1, it explains the big picture of O&P, in Chapter 2 It covers the laws and rules guiding O&P while emphasizing aircraft maintenance. Then in Chapter 3 it discusses the A-76 study process in detail. In Chapter 4 it supplies the views articulated by various high-level studies and leaders. Next, in Chapter 5, it provides qualitative data from real world experiences with outsourcing of aircraft maintenance. Finally in Chapter 6 It submits the author's conclusions drawn from the material presented

DTIC

Aircraft Maintenance; Military Aircraft

19990105810 Naval Postgraduate School, Monterey, CA USA

Improving Naval Aviation Maintenance Quality Management Processes at the Organizational Maintenance Level: The Influences of the International Standards Organization (ISO) 9000 Quality Management System on the Naval Aviation Maintenance Program

Couch, Christopher J.; Decker, Duane L.; Jun. 1999; 251p; In English

Report No.(s): AD-A367296; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

This thesis examines the similarities and differences between the Naval Aviation Maintenance Program (NAMP) and International Standards Organization (ISO) 9000 quality management systems (QMS), discusses the difference in quality management discipline under ISO 9000 and under the NAMP, and describes what must be changed in the aviation organizational maintenance sections of the NAMP to make them consistent with the ISO 9000 QMS. The NAMP is Naval aviation's overall guiding document that outlines command, administrative, and management relationships, and assigns maintenance policy and procedure responsibilities to the respective individuals for management ISO 9000 is a series of international standards establishing requirements and guidelines for maintaining an organization's quality system. An overview is provided of quality management (QM) procedures, policies, tools, and audits; the NAMP Quality Management System (QMS); the ISO 9000 QMS; and QMS implementation procedures. Next, process maps are described for QM documentation, policies, and procedures under both the NAMP and ISO 9000. Each is compared and contrasted. Then, QM training under the NAMP and ISO 9000 is described, and advantages and disadvantages of each are listed. ISO 9000 QMS implementation issues and performance metrics are discussed. Finally, recommended changes to NAMP QM procedures, processes, and policies are provided.

DTIC

Navy; Aircraft Maintenance; Policies

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery. For related information see also 34 Fluid Mechanics and Heat Transfer.

19990100643 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA

An Inviscid Computational Study of an X-33 Configuration at Hypersonic Speeds

Prabhu, Ramadas K., Lockheed Martin Engineering and Sciences Co., USA; July 1999; 26p; In English

Contract(s)/Grant(s): NAS1-96014; RTOP 242-80-01-01

Report No.(s): NASA/CR-1999-209366; NAS 1.26:209366; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report documents the results of a study conducted to compute the inviscid longitudinal aerodynamic characteristics of a simplified X-33 configuration. The major components of the X-33 vehicle, namely the body, the canted fin, the vertical fin, and the body-flap, were simulated in the CFD (Computational Fluid Dynamic) model. The rear-ward facing surfaces at the base including the aerospike engine surfaces were not simulated. The FELISA software package consisting of an unstructured surface and volume grid generator and two inviscid flow solvers was used for this study. Computations were made for Mach 4.96, 6.0, and 10.0 with perfect gas air option, and for Mach 10 with equilibrium air option with flow condition of a typical point on the X-33 flight trajectory. Computations were also made with CF4 gas option at Mach 6.0 to simulate the CF4 tunnel flow condition. An angle of attack range of 12 to 48 deg was covered. The CFD results were compared with available wind tunnel data. Comparison was good at low angles of attack; at higher angles of attack (beyond 25 deg) some differences were found in the pitching

moment. These differences progressively increased with increase in angle of attack, and are attributed to the viscous effects. However, the computed results showed the trends exhibited by the wind tunnel data.

Author

Computational Fluid Dynamics; Inviscid Flow; Viscous Flow; Unstructured Grids (Mathematics); X-33 Reusable Launch Vehicle; Venturestar Launch Vehicle; Aerospike Engines

19990100650 NASA Langley Research Center, Hampton, VA USA

Static Performance of a Fixed-Geometry Exhaust Nozzle Incorporating Porous Cavities for Shock-Boundary Layer Interaction Control

Asbury, Scott C., NASA Langley Research Center, USA; Hunter, Craig A., NASA Langley Research Center, USA; August 1999; 139p; In English

Contract(s)/Grant(s): RTOP 538-14-12-01

Report No.(s): NASA/TM-1999-209513; NAS 1.15:209513; L-17879; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

An investigation was conducted in the model preparation area of the Langley 16-Foot Transonic Tunnel to determine the internal performance of a fixed-geometry exhaust nozzle incorporating porous cavities for shock-boundary layer interaction control. Testing was conducted at static conditions using a sub-scale nozzle model with one baseline and 27 porous configurations. For the porous configurations, the effects of percent open porosity, hole diameter, and cavity depth were determined. All tests were conducted with no external flow at nozzle pressure ratios from 1.25 to approximately 9.50. Results indicate that baseline nozzle performance was dominated by unstable, shock-induced, boundary-layer separation at over-expanded conditions. Porous configurations were capable of controlling off-design separation in the nozzle by either alleviating separation or encouraging stable separation of the exhaust flow. The ability of the porous nozzle concept to alternately alleviate separation or encourage stable separation of exhaust flow through shock-boundary layer interaction control offers tremendous off-design performance benefits for fixed-geometry nozzle installations. In addition, the ability to encourage separation on one divergent flap while alleviating it on the other makes it possible to generate thrust vectoring using a fixed-geometry nozzle.

Author

Exhaust Nozzles; Porosity; Hole Geometry (Mechanics); Cavities; Thrust Vector Control

19990102866 NASA Marshall Space Flight Center, Huntsville, AL USA

A Collaborative Analysis Tool for Integrating Hypersonic Aerodynamics, Thermal Protection Systems, and RBCC Engine Performance for Single Stage to Orbit Vehicles

Stanley, Thomas Troy, International Space Systems, Inc., USA; Alexander, Reginald, NASA Marshall Space Flight Center, USA; 1999; In English; Space Planes and Hypersonic Systems and Technologies, 4-9 Nov. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Presented is a computer-based tool that connects several disciplines that are needed in the complex and integrated design of high performance reusable single stage to orbit (SSTO) vehicles. Every system is linked to every other system, as is the case of SSTO vehicles with air breathing propulsion, which is currently being studied by NASA. The deficiencies in the scramjet powered concept led to a revival of interest in Rocket-Based Combined-Cycle (RBCC) propulsion systems. An RBCC propulsion system integrates airbreathing and rocket propulsion into a single engine assembly enclosed within a cowl or duct. A typical RBCC propulsion system operates as a ducted rocket up to approximately Mach 3. At this point the transitions to a ramjet mode for supersonic-to-hypersonic acceleration. Around Mach 8 the engine transitions to a scram4jet mode. During the ramjet and scramjet modes, the integral rockets operate as fuel injectors. Around Mach 10-12 (the actual value depends on vehicle and mission requirements), the inlet is physically closed and the engine transitions to an integral rocket mode for orbit insertion. A common feature of RBCC propelled vehicles is the high degree of integration between the propulsion system and airframe. At high speeds the vehicle forebody is fundamentally part of the engine inlet, providing a compression surface for air flowing into the engine. The compressed air is mixed with fuel and burned. The combusted mixture must be expanded to an area larger than the incoming stream to provide thrust. Since a conventional nozzle would be too large, the entire lower after body of the vehicle is used as an expansion surface. Because of the high external temperatures seen during atmospheric flight, the design of an airbreathing SSTO vehicle requires delicate tradeoffs between engine design, vehicle shape, and thermal protection system (TPS) sizing in order to produce an optimum system in terms of weight (and cost) and maximum performance.

Derived from text

Hypersonic Speed; Aerodynamics; Thermal Protection; Launch Vehicles; Computer Techniques; Ducted Rocket Engines; Propulsion System Performance; Ramjet Engines; Single Stage to Orbit Vehicles

Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Analysis of Aerodynamic Characteristics of 150mm Diameter Ballistic Rocket *Analisa Karakteristik Aerodinamika Roket Balistik Penjaga Selat*

Ginting, Salam, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; January 1999; ISSN 0126-0480; Volume 1, No. 1, pp. 7-20; In Malay-Indonesian; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper presents the analysis on the aerodynamic characteristics of a 150 mm diameter ballistic rocket. The rocket is intended to be used in a tactical strait defense. The methods used in the analysis are mostly from the N.F. Krasnov aerodynamic theory since the book focuses on the specific rocket technology. The obtained aerodynamic characteristics are shown in the form of lift, drag, and moment curves. The aerodynamic coefficient data was used as an input to predict the static stability of the rocket in subsonic and supersonic speed. The data also used in designing the rocket trajectory and range, so that the rocket will be effective as a weapon in defending strait. As a comparison and to validate the calculation, the data from similar rocket which has been tested in Indonesia and abroad are also presented.
Author
Rocket Vehicles; Aerodynamic Drag; Lift; Ballistics

NASA Lewis Research Center, Cleveland, OH USA

Vortex/Body Interaction and Sound Generation in Low-Speed Flow

Kao, Hsiao C., NASA Lewis Research Center, USA; September 1998; 36p; In English
Contract(s)/Grant(s): RTOP 522-31-23
Report No.(s): NASA/TM-1998-208403; NAS 1.15:208403; E-11235; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The problem of sound generation by vortices interacting with an arbitrary body in a low-speed flow has been investigated by the method of matched asymptotic expansions. For the purpose of this report, it is convenient to divide the problem into three parts. In the first part the mechanism of the vortex/body interaction, which is essentially the inner solution in the inner region, is examined. The trajectories for a system of vortices rotating about their centroid are found to undergo enormous changes after interaction; from this, some interesting properties emerged. In the second part, the problem is formulated, the outer solution is found, matching is implemented, and solutions for acoustic pressure are obtained. In the third part, Fourier integrals are evaluated and predicated results presented. An examination of these results reveals the following: (a) the background noise can be either augmented or attenuated by a body after interaction, (b) sound generated by vortex/body interaction obeys a scaling factor, (C) sound intensity can be reduced substantially by positioning the vortex system in the "favorable" side of the body instead of the "unfavorable" side, and (d) acoustic radiation from vortex/bluff-body interaction is less than that from vortex/airfoil interaction under most circumstances.
Author
Vortices; Sound Generators; Background Noise

Lockheed Martin Engineering and Sciences Co., Hampton, VA USA

Transonic Dynamics Tunnel Force and Pressure Data Acquired on the HSR Rigid Semispan Model

Schuster, David M., Lockheed Martin Engineering and Sciences Co., USA; Rausch, Russ D., Lockheed Martin Engineering and Sciences Co., USA; September 1999; 50p; In English
Contract(s)/Grant(s): NAS1-96014; RTOP 537-06-36
Report No.(s): NASA/CR-1999-209555; NAS 1.26:209555; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report describes the aerodynamic data acquired on the High Speed Research Rigid Semispan Model (HSR-RSM) during NASA Langley Transonic Dynamics Tunnel (TDT) Test 520 conducted from 18 March to 4 April, 1996. The purpose of this test was to assess the aerodynamic character of a rigid high speed civil transport wing. The wing was fitted with a single trailing edge control surface which was both steadily deflected and oscillated during the test to investigate the response of the aerodynamic data to steady and unsteady control motion. Angle-of-attack and control surface deflection polars at subsonic, transonic and low-supersonic Mach numbers were obtained in the tunnel?s heavy gas configuration. Unsteady pressure and steady loads data were acquired on the wing, while steady pressures were measured on the fuselage. These data were reduced using a variety of methods, programs and computer systems. The reduced data was ultimately compiled onto a CD-ROM volume which was distributed to HSR industry team members in July, 1996. This report documents the methods used to acquire and reduce the data, and provides an assessment of the quality, repeatability, and overall character of the aerodynamic data measured during this test.
Author
Transonic Wind Tunnels; Dynamic Tests; Semispan Models; Data Reduction; Aerodynamics; Supersonic Transports

Includes passenger and cargo air transport operations; and aircraft accidents. For related information see also 16 Space Transportation and 85 Urban Technology and Transportation.

19990099349 Nebraska Univ., Aviation Inst., Omaha, NE USA

The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG), Volume 3

Reynolds–Feighan, Aisling, Editor, University Coll., Ireland; Bowen, Brent D., Editor, Nebraska Univ., USA; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; 232p; In English, 19-21 Jul. 1998, Dublin, UK; Sponsored by World Conference on Transportation Research Society, Unknown
Contract(s)/Grant(s): NAGw-4414
Report No.(s): UNOAI-98-5; Copyright Waived; Avail: CASI; A11, Hardcopy; A03, Microfiche

Contents include the following: airline deregulation in Australia: a medium term assessment; why can't Japan deregulate the airline industry and open the sky immediately?; toward a market-oriented air transport system?: present developments in Russian civil aviation performance and policy; the asian economic crisis and its implications for aviation policy in asia pacific: industry outlook approaching the next millennium; a tale of two airlines: the post privatization performance of two caribbean airlines: the role of capital productivity in British Airways' financial recovery; airline privatization: does it matter?; airfright demand: responding to new developments in logistics; and air cargo business relationships.
CASI
Conferences; Productivity; Policies; Logistics; Airline Operations; Air Cargo

19990099350 Monash Univ., Clayton, Australia

Airline Deregulation in Australia: A Medium Term Assessment

Forsyth, Peter, Monash Univ., Australia; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 3; 15p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In 1990, Australia deregulated its domestic air transport. Prior to deregulation there had been two trunk airlines which had been subjected to tight regulation, though there had been some liberalisation during the 1980s. International comparisons of costs and productivity suggested that there was considerable scope for efficiency improvement, and that deregulation would provide the impetus for substantial productivity growth. The early deregulation period saw two serious attempts at entry, but both of these failed, leaving the same two airlines dominating the market. Early studies have suggested some moderate, though certainly not large, productivity gains since deregulation; since these were done, there have not been major changes. Available evidence in recent years is evaluated to determine how performance has changed over the post deregulation period, and how it compares to performance overseas, for example, in North America. Analysis is made more difficult by reductions in data availability since deregulation. Emphasis is given to changes in productive efficiency, since this is likely to be the main source of welfare gain, though other changes,are also considered. The paper assesses whether the expected gains have been achieved. The paper concludes with an interpretation of the results. The relatively modest improvement, coupled with a remaining gap in performance compared with overseas, raises the issue of whether competition between two dominant airlines is sufficiently strong to ensure minimum cost production. If so, there may be a lesson in this for other small to medium sized airline markets. Another explanation of the results may lie with the airline labor market; unlike what happened after US deregulation, there has been little change in airline labor markets, and possibly Australian labor market arrangements are hindering the achievement of overseas levels of productivity.
Author
Market Research; Cost Effectiveness; Commercial Aircraft; Airline Operations; Regulations

19990099351 Doshisha Univ., Kyoto, Japan

Why Can't Japan Deregulate the Airline Industry and Open the Sky Immediately?

Sakakibara, Yasuo, Doshisha Univ., Japan; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); 19981201; Volume 3; 14p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A brief history of deregulation in Japan: 1. Dividing the market into three airlines (1970). 2. Some relaxation of the "constitution (1985). and 3. More relaxation in domestic market (1995-97). When Japan was allowed to reopen civil aviation and Japan Airlines (JAL) was reestablished in 1953, no Japanese government official, no member of the government committee on civil aviation, and nobody in the airline business could imagine that the new JAL would become profitable in a few years and that it would grow to be one of the established air carriers of the world. Therefore, the civil aviation policy of the Japanese Ministry of Transport JMOT) was geared entirely to strengthen JAI:s position as Japan's "flag canrier." The JAL's performance improved with

'the Jimmu boom' of 1956 Jimmu was the first legendary emperor of Japan, and the term Jimmu boom means boom without any precedent). JAL made a profit from '55 to '61 and paid dividends to private stockholders in '60 for the first time (The government owned the majority of its stocks)'. On the other hand, none of the many small regional airlines boom after the reopening of the civil aviation were making money. The JMOT recommended (an administrative guidance)' that small ones be merged into larger ones. A series of mergers followed and two airlines emerged: All Nippon Airways (ANA) and Toa-Domestic Airlines (TDA ... later changed to Japan Air System, JAS). Soon after the three major airlines, JAL, ANA and TDA, came to existence, an understanding of a cabinet meeting was issued (1970). This understanding came to be called 'the constitution' of civil aviation because it completed the regulatory system and because it was strictly observed, however informal the regulatory dictations were. What the constitution did was to divide the market into three airlines.

Derived from text

Airline Operations; Civil Aviation; Japan

19990099352 College of William and Mary, School of Business Administration, Williamsburg, VA USA

Toward a Market-Oriented Air Transport? Recent Developments in Russian Civil Aviation Performance and Policy

Strong, John S., College of William and Mary, USA; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 3; 10p; In English; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

After seven years of declining demand and deteriorating performance, the Russian civil aviation sector began what might be an incipient recovery in 1997. This paper describes the performance and emerging industry, structure, and main policy issues as of early 1998. Due to the lack of consistent data and the difficulty securing public release of the information that is available, this paper should not be viewed as a in traditional academic analysis, but rather more of a clinical study.

Author

Air Transportation; Policies; Russian Federation

19990099353 Sydney Univ., Australia

The Asian Economic Crisis and Its Implications for Aviation Policy in Asia Pacific

Hooper, Paul, Sydney Univ., Australia; Chin, Anthony, National Univ. of Singapore, Singapore; Cain, Robert, Tourism Futures International, Australia; The Symposium Proceedings of the 1998 Air Transport Research Group (ATRG); December 1998; Volume 3; 10p; In English; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Up until the second half of 1997, there was widespread confidence that commercial air transport activity would grow more quickly in the Asia Pacific region than it would in other markets. The airlines based in the region embarked upon costly re-equipment and expansion plans while the major carriers in North America and Europe actively expanded their presence by extending their networks and alliances. The rapid growth put pressure on the governments in the region to relax their approach to competition and the result was the emergence of new Asian airlines with ambitious plans, open skies agreements with the United States, and agreements to form regional aviation markets in South East Asia. Within APEC there was a commitment to pursue a more competitive air services regime. Even before the currency crises leading to AMF bail-out packages for Thailand, Indonesia and South Korea, the airlines were losing traffic because of a variety of special conditions such as the smog conditions associated with the forest fires in Indonesia. However, the abrupt decline in wealth, the spate of business failures, fears of job insecurity and austere economic programmes that occurred in late 1997 had catastrophic impacts on traffic levels for some markets. At the same time, the region's airlines were highly exposed to currency movements and their debt obligations escalated sharply along with interest rates. Many other airline costs are incurred in hard currencies and the airlines have moved rapidly to refinance their fleets, reorganize their routes and to take greater advantage of alliances. The adjustment process will continue for some time and it will involve far-reaching changes. This paper examines the impacts of the economic crises on the airlines and the responses being pursued by management. Given the trend towards more liberal competition policies, an important question is whether the current circumstances are likely to lead to a return to more protectionist attitudes. The temptation to shield carriers from competition will have to be balanced against the need to open up markets, to forge alliances and to attract investment We argue there are strong forces likely to support further liberalisation.

Author

Airline Operations; Asia; Competition; Economics; Market Research; Policies

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Industry Outlook Approaching the Next Millennium

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By any standards, 1997 was a banner year for the aviation industry. World passenger traffic increased by just under 7% over 1996 with the result that total demand was over one-third greater than just four years earlier in 1993 .... an average rate of increase of 7.5% pa or nearly 50% above the consensus forecast for long-run growth. While total deliveries of 100 seat jets increased from 438 in 1996 to 582 last year, the four year average of 490 pa was some 20% less than the consensus forecast of long-run demand. This almost unprecedented four year favorable trend in supply versus demand has resulted in load factors increasing from 66% in 1993 to 71% last year while the number of surplus aircraft declined from nearly 1,200 (11 % of the world fleet) at the end of 1993 to 260 representing just 2% of the world fleet at the end of 1997. The world's airlines recorded record net profits of $7.5B last year compared with $4.4B losses in 1993 which itself followed record losses of $7.9B in 1992. The swing for the US airlines, which account for about one-third of world airline revenues, was even more impressive over this five year period .... going from a $3B loss in 1992 to a $4B profit in 1997. Manufacturers, too, have benefited from near record orders for 1,348 new jets in 1997 (a, 14% increase over the 1,186 ordered in 1996) bringing the firm order backlog up to 3,117. In the leasing sector, the growing aircraft shortage showed up in terms of strong demand for most popular types of modem narrow-body and wide-body aircraft with a commensurate strengthening of lease rates.
Author

Aircraft Industry; Airline Operations; Commercial Aircraft; Forecasting; Industries

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An Empirical Analysis of Japan's Domestic Airline Markets, Pt. 1, Airfares Under the Regulatory Regime: What will be expected After the Revision of the Current Charging System?

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This paper statistically investigates the charging system of Japanese domestic airfares and predicts the effect of the revision of the current system on the consumer's surplus. Using 222 observations of cross-sectional data from 1995, Part I of this paper empirically demonstrates that (1) the airfares in the long haul routes were set relatively high regardless of the number of passengers, (2) in the outstandingly dense routes, the airfares were set higher than the predicted full cost levels, and (3) in the thin and shorter haul routes, airfares were a little lower. Considering the price elasticity of these three types of routes, this paper concludes the reduction of airfares.
Author

Airline Operations; Costs; Market Research; Statistical Analysis

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A Tale of Two Airlines: The Post Privatisation Performance of Two Caribbean Airlines

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Under severe fiscal pressures and in the wake of continuing poor performance of their airlines, the governments of Jamaica and Trinidad and Tobago were forced to privatise their flag carrier. Privatisation was expected to lead to much improved performance in an increasingly competitive environment. Three years after privatisation and despite the governments taking over all of the airlines' debt, the two privatized airlines have once more accumulated huge losses, with one airline almost on the verge of bankruptcy. This paper takes a comparative look at the post-privatisation performance of both airlines. The paper examines the strategies adopted by these privatised airlines in the face of intense competition from their .much larger rivals. Finally the paper considers whether small, unsupported airlines can survive in the new competitive environment.
Author

Airline Operations; Caribbean Region; Commercial Aircraft; Competition

19990099361 Nebraska Univ., Aviation Inst., Omaha, NE USA

The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society, Volume 4

Bowen, Brent D., Editor, Nebraska Univ., USA; Oum, Tae Hoon, Editor, British Columbia Univ., Canada; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; 304p; In English; 8th; Transportation Research, 12-17 Jul. 1998, Antwerp, Belgium; Sponsored by World Conference on Transportation Research Society, Unknown

Contract(s)/Grant(s): NAGw-4414

Report No.(s): UNOAI-98-9; Copyright Waived; Avail: CASI; A14, Hardcopy; A03, Microfiche

The Air Transport Research Group of the WCTR Society was formally launched as a special interest group at the 7h Triennial WCTR in Sydney, Australia in 1995. Since then, our membership base has expanded rapidly, and now includes over 400 active transportation researchers, policy-makers, industry executives, major corporations and research institutes from 28 countries. It became a tradition that the ATRG would hold an international conference at least once a year. In 1998, the ATRG organized a consecutive stream of 14 aviation sessions at the 8th Triennial WCTR Conference (July 12-17: Antwerp). Again, on 19-21 July, 1998, the ATRG Symposium was organized and executed every successfully by Dr. Aisling Reynolds-Feighan of the University College of Dublin. The Aviation Institute at the University of Nebraska at Omaha has published the Proceedings of the 1998 ATRG Dublin Symposium (being co-edited by Dr. Aisling Reynolds-Feighan and Professor Brent Bowen), and the Proceedings of the 1998 WCTR- ATRG Conference (being co-edited by Professors Tae H. Oum and Brent Bowen).
Author

Air Transportation; Conferences; Operating Systems (Computers)

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The Link Between Total Factor Productivity, Prices and Financial Performance: Applications to Air and Rail Transportation

Waters, W. G., II, British Columbia Univ., Canada; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 16p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Total factor productivity (TFP) has been a principal means of measuring performance both for monitoring performance improvement over time as well as performance comparisons across firms. Productivity compares output quantities with quantities of inputs (more specifically, the growth in outputs relative to the growth in inputs). However, strong productivity performance is not necessarily an indicator of strong financial performance; and the converse is true as well, for example, firms with market power can achieve profitability despite poor productivity performance. There is reason to expect some correlation between productivity and financial performance, but the relationship is not exact. Stated simply, productivity compares quantifies of outputs relative to quantities of inputs. Financial performance depends on the revenues from outputs compared to the expenditures on inputs. A firm can be very efficient in terms of outputs per input, but it could be highly unprofitable if the revenues received are low compared to what it pays for inputs. Conversely, a firm with market power might be inefficient in input use but compensate financially by changing high prices. Nonetheless, it is possible to establish a direct link between productivity changes and financial performance.
Author

Productivity; Cost Analysis; Financial Management; Air Transportation; Rail Transportation

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Liberalization or Controlled Competition? The Development of Scheduled Domestic Air Transport in Germany and Japan, Focusing on the Fare System

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Report No.(s): Paper-886-Rev; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

For decades domestic air transport markets in Germany and Japan developed in a strictly regulated environment However, due to political and economical necessities a deregulation process started that led to changes in the market structure especially of scheduled passenger transport. In 1986, the Japanese government changed its air transport policy towards a deregulation policy; in Europe liberalization of air transport was part of the measures to build a common market with equal opportunities for all airlines. In consideration of the results of the rapid deregulation process in the US which caused numerous bankrupts, in Japan and EU it was decided to deregulate the market more gradually. But, whereas in Japan the introduction of new airlines was restricted under law, in Germany, along with the liberalization policy on EU level since the late 1980s, new airlines could enter the scheduled air transport market starting vivid competition with Lufhansa on some major domestic city- pair relations. In Japan, under the controlled competition system eight airlines compete in the domestic mark-el Where competition can be offered, price reductions can take place. Therefore, the analysis focuses on the different approach in deregulating the domestic market in both countries. Regarding the effects of deregulation in the Japanese domestic market, recent developments and changes in market structure and passenger fares for both countries will be investigated, thus answering the question whether controlled competition and the still ongoing process of deregulation can lead to fare competition between airlines as it is the case in Germany.
Author

Airline Operations; Civil Aviation; Competition; Market Research; Policies

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France, Progress of the Interior Laboratory of Aerial Transport *La France, Laboratoire du Marche Interieur du Transport Aerien*

Bonnet, Dominique, Ecole Nationale de l'Aviation Civile, France; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 18p; In French; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

After a long period of neglect and waiting which lasted until the bilateral relationship between member states, in the year 1986, there is incontestable progress in the evolution of aerial transport in the European Union. With the signature in February 1986 of the Unique European Act, the beginning of interior progress has been fixed at 31 December 1992. Some weeks much later in April 1986, the Court of European Justice rendered its judgment called "New Frontiers" which stipulated the general rules of relations of Rome, but also their concern with concurrent as applied to aerial transport. Thus was completed the final joining of the political agreement and the judicial conditions which allowed preparation of common aerial transport authority, outlined by the commission in its memorandum of March 1984. The principal support of this policy, the realization of an Interior Department of Aerial Transport was achieved in April 1997 with the establishment of a period of transition and adaptation of about twenty years. The preparations of this work concerned France in two large periods: six years of preparation during of which fixed routes which had been poorly marked were established, (2) the succession of an acceleration phase which imposed, occasionally by radical methods, a complete change in the organization of French Aerial Transport, (3) the multiple consequences imposed on industry, (4) the state, and (5) after the laboratory has been established by this process, the French Aerial Transport should progressively insert gradual growth in true transeuropean research.
Author

Air Transportation; Policies; Progress

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Air Travel Demand Projections Through 2010: The Case Study of Istanbul Ataturk Airport

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This study evaluates the current traffic capacity of Istanbul Ataturk Airport in order to investigate the possibility of an increase in efficiency and to specify the need for a second airport in Istanbul. The research is based on traffic demand projections (passenger, aircraft, and cargo) for the Ataturk Airport until 2010. Initially, regression models are separately developed for international and domestic passenger traffic, cargo traffic, and aircraft traffic. Subsequently, in order to make reliable projections until 2010, four different scenarios are developed. Scenario 1 is based on trend analysis while the others assume that variables will show fluctuations similar to previous years' but with different rates. Scenario 2 represents the status quo while Scenario 3 and 4 represents the optimistic and pessimistic cases respectively. All the scenarios reveal that the Ataturk Airport urgently needs supplementary terminal buildings and runways, and that a second airport in Istanbul is indispensable.
Author

Air Traffic; Trend Analysis; Evaluation; Air Transportation; Cargo; Passengers

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A Hands-On Analysis of the Future Framework of the European Airline Industry Using a Software-Assisted Scenario-Methodology

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Presently, the European airline industry features some ambivalent characteristics. On the one hand side its passenger numbers as well as its freight tonnage show strong signs of growth, on the other hand side the industry is confronted with a difficult situation, i.e. burdened with infrastructural shortcomings and uncertainties, e.g. with respect to what will happen after the 3-rd liberalisation package has come into effect. Moreover, some airlines already have or are in the midst of undergoing comprehensive restructuring and privatisation, whilst others remain in their respective state's hands yet and/ or are heavily subsidized. This plus the ongoing economic work sharing worldwide, high growth rates in tourism and their influence on aviation necessitate a deeper understanding of and insight into the dependencies of the air transport system. Whereas the airline analyst can assume that most European airlines have already made and are implementing the planning and strategic decisions covering the near future, the more distant future implies more scope of action and thus more uncertainty of what business ideas should be realised and what strategies applied and when. Also, the airline strategist is only partly aware of what prospective activities are pursued by the airline's competitors. Fur-

thermore, technological ‚quantum leaps" do not follow deterministic patterns and thus are very difficult to predict. Strategic decisions with regard to greater investments or the implementation of far-reaching strategies focused on various business units (i.e. their market behaviour) require an extensive outlook into the further future. This is imperative for an early identification of relevant developments (early warning) and the realization of their consequences on the industry as a whole, so as to maintain an airline's competitive advantage over its competitors. For this scenarios suggest themselves. Applied to the underlying topic, they serve as a first step to assess the potential of yet-to-be finalized developments within the European airline industry. The aim of the scenario process conducted here is to provide decision-makers in the airline industry, air transport analysts and personnel of state authorities and of other institutions involved with possible, conceivable and consistent future perspectives regarding the European air transport industry. This knowledge will enable all the interested parties to subject their objectives and actions to an examination of costs and benefits, help to avoid or make use of specific risks and chances and to maintain or better their place in the top league. The application of the scenario-methodology to the problem field mentioned above and illustrated in this paper was realised by collaborating with other experts (both scientists and practioneers) from all over the aviation field, following the process in figure 1. The aim was to reach as good an understanding of the European airline industry now and in the future as was possible in the given time frame.

Derived from text

Technology Transfer; Air Transportation; Airline Operations; Cargo; Early Warning Systems; Government/Industry Relations

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External Costs of Road, Rail and Air Transport: A Bottom-Up Approach

Weinreich, Sigurd, Centre for European Economic Research, Germany; Rennings, Klaus, Centre for European Economic Research, Germany; Gessner, Christian, Centre for European Economic Research, Germany; Schlomann, Barbara, Fraunhofer-Inst. fuer Systemtechnik und Innovationsforschung, Germany; Engel, Thomas, Fraunhofer-Inst. fuer Systemtechnik und Innovationsforschung, Germany; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 20p; In English

Report No.(s): Paper-938-Rev; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper describes the most important results of the external quality valuation in the QUITS project funded by the European Commission (DG VII) under the Transport RTD Programme of the 4th Framework Programme. The objective of QUITS was to develop a methodology for valuing internal and external quality dimensions of transport systems. A uniform methodology is applied for calculating external costs of transport for different types of impacts and transport modes. The evaluation of the. external costs of road, rail and air traffic for both passenger and goods =sport is based on a bottom-up approach, which means that the starting point for the analysis is the micro-level. This is standard in cost-benefit analysis. We adopted the impact pathway approach developed in the ExternE project. Due to limited space, this paper will focus on the comparison of external costs between modal alternatives for the route Frankfurt - Milan. This Origin- Destination relation is transnational, covers all major kinds of transport-related externalities and offers a real modal choice. The bottom-up approach can be applied both, to support a netwide analysis and for local and route specific cost-benefit analysis. Monetary valuation is essential to get an orientation towards fair and efficient pricing.

Author

Air Traffic; Cost Effectiveness; Procedures; Computation

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Performance Evaluation of Carriers by North American Companies

Brooks, Mary R., Dalhousie Univ., Canada; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 20p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

According to the trade press, performance evaluation in North America is well underway. This paper reports the findings of a research study to examine the assessment of carrier performance by users and suppliers of North American transportation services. As a descriptive study, it examines the approaches of cargo suppliers (manufacturers) to the evaluation of their transport suppliers' performance-incidence of monitoring, methods, responsibility for and use of findings-in order to understand the business practices taking place. These findings are then contrasted with similar elements from the points of view of carriers and logistics service firms. The paper does not explore the issue of performance assessment from a macro-economic focus but rather from one of firm-specific program implementation. It concludes that the perception advanced by the trade press is not the reality reported by companies in the marketplace.

Author

Evaluation; Research; Performance Tests; Transportation; North America

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The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society, Volume 2

Oum, Tae Hoon, Editor, British Columbia Univ., Canada; Bowen, Brent D., Editor, Nebraska Univ., USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; 320p; In English; 8th; Transportation Research, 12-17 Jul. 1998, Antwerp, Belgium; Sponsored by World Conference on Transportation Research Society, Unknown; See also 19990099397 through 19990099414

Contract(s)/Grant(s): NAGw-4414

Report No.(s): UNOAI-98-7; Copyright Waived; Avail: CASI; A14, Hardcopy; A03, Microfiche

    Contents include the following: Airport choice in a multiple airport region: an empirical analysis for the San Francisco bay area. Liberalization of the westeuropian aviation: choice of a new hub airport for an airline. Austin Bergstrom airport traffic control tower establishment of a major activity level tower. A study to optimize the environmental capacity of Amsterdam airport schiphol.Airport performance in stakeholder involvement and communication strategies: a comparison of major Australian and North American air carrier and general aviation airports. Airport planning and location.Location of international airport and regional development. A simulation technique for analysis of Brasilian airport passanger terminal building.Multimodal airport access in Japan. Planning surface access provision at major airports Airline economics and the inclusion of environmental costs on airport hub pricing: a theoretical analysis. Airport financing and user charge systems in the USA. Optimal demand for operating lease of aircraft. Aircraft leasing industry and social welfare.The development of performance indicators for airports: a management perspective. Study about operational effect of the "security check-in" implantation in Brasilian international airports.Austin Bergstrom west loop cable system.and Optimal resource allocation model for airport passanger terminals.

CASI

Conferences; Resource Allocation; Economics; Costs; Airport Towers; Airport Planning; Aircraft Industry; Airline Operations; Air Traffic Control; Air Transportation

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Airport Choice in a Multiple Airport Region: An Empirical Analysis for the San Francisco Bay Area

Pels, Eric, Vrije Univ., Netherlands; Nijkamp, Peter, Vrije Univ., Netherlands; Rietveld, Piet, Vrije Univ., Netherlands; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 22p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

    In this paper a nested logit model is used to describe passenger preferences concerning airports and airlines. A statistical model for the passengers' sequential choice of airport and airline is calibrated. It appears that the choice sequence first airport, then airline is statistically preferable to the reversed choice sequence. Frequency, the average number of seats offered by an airline and access time to the airport are all significant. Separate models are estimated for business and leisure travelers, but there appear to be only small differences.

Author

San Francisco Bay (CA); Airports; Mathematical Models; Numerical Analysis; Commercial Aircraft

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Liberalisation of the West European Aviation: Choice of a New Hub Airport for an Airline

Milan, Janic, Alfa SP IFA, Slovenia; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 21p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

    The European air transport system consists of the airports, air traffic control and airlines. The physical characteristics and traffic volumes of the European air transport system have been impressive. According to data provided by A.E.A. (Association of European Airlines), over 210 airports have operated in the Western Europe. In the EU (European Union) countries over 100 airports have served the annual traffic overcoming more than 250000 air passengers and 10000 tonnes of air cargo (104 cities have been served by 110 airports). The European air traffic has been controlled by 45 Air Traffic Control centres which have been subdivided into 191 low-altitude and 212 high-altitude sectors (CEC,1994). More than 200 airlines have operated at the Western European airports (approximately 145 of them have managed their flights within the EU Member States). They have carried out about 50% of all services as scheduled services. The most famous European airlines have been 22 'flag- carriers'. They have scheduled their flights on the main inter-European and intercontinental routes. The largest airlines have been Lufthansa, British Airways and Air France. Each of them has transported more than 28 million passengers per year (ATAG, 1996; Janic, 1996). The European aviation market represents an important part of the world's aviation market. The following figures support this assertion (ATAG, 1996). In 1993 the total air transport demand was nearly 390 million of passengers. Domestic scheduled and charter traffic represented about 30% of this total. International scheduled traffic shared a little bit more than 50% of the total. International charter

participated in this total with about 20%. Whole region shared around 54% of the total world-wide international scheduled traffic. More than a half of these passengers traveled over Europe. For years, the dominant inter-European traffic flows have run between UK (UK) and France (around 6,2 million), UK and Germany (5,13 million), and UK and Ireland (4,3 million), (ATAG, 1996). The relationships between the airlines operating in the European air route network have been regulated for years by more than 200 bilateral agreements (Button and Swann,1991). In 1987 the process of gradual liberalisation (deregulation) of the EU (European Union) aviation markets started. It has lasted for the past decade (1987/1993/1997). The process has been performed by implementation of three 'Aviation Liberalisation Packages' which provided institutional (legislative) conditions for free operations of the EU airlines over the area of Member States. Although they have completely started to be in effect from January 1993 the last barrier has been removed in April 1997. After that time, as in US the airlines have become freed to fly anywhere they want (between any two points) within the EU, set-up the airfares and enter or leave from the particular markets (routes). The national flag airlines have been consolidating their domestic hub-and-spokes networks for years. After full liberalisation (deregulation) of the EU market, some of them will intend to strength their presence in the 'core' area of Europe (IFAPA, 1988; Janic, 1996). Besides the merging and alliances this will be carried out by establishing of a new hub airport in the core area'. The objective of this paper has been to develop the methodology which will be able to support easier, more transparent and consistent choice of a new hub airport by an airline. Besides this introductory section, the paper consists of five sections. Section 2 describes the 'Liberalisation Packages' concerning the EU aviation market. As well, it contains description of the main developments of this market that have happened for the past decade. Section 3 deals with the problem of 'crossing the national borders' by the airlines during 'transition' period. Section 4 covers the proposed methodology for evaluation of the 'preferable' location of new 'hub' airport. Section 5 contains the numerical example. The last Sections (6) represents the conclusions.
Author
Air Traffic Control; Air Transportation; Airline Operations; Airports; Commercial Aircraft; Market Research

19990099407 Geneva Univ., Dept. of Economics, Geneva, Switzerland
Airline Economics and the Inclusion of Environmental Costs on Airport Hub Pricing: A Theoretical Analysis
Nero, Giovanni, Geneva Univ., Switzerland; Black, John A., New South Wales Univ., Australia; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 28p; In English; See also 19990099396
Contract(s)/Grant(s): SNSF-8212-50417; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Previous studies into hub airports have tended to concentrate on the economic dimensions, such as market power, airline fares and barriers to entry. Airline hubbing has considerably altered airport economics: it increases the number of flights into and out of a major airport and it increases externalities such as airside and landside congestion, aircraft noise and emissions. The principal contribution of our paper is to focus on the environmental externalities associated with extensive hubbing. In the first part of the paper we present a conceptual spatial model which addresses the environmental impacts related to extensive hubbing. In the second part of the paper, we formally address the conceptual problem by proposing a model of airline economics. Schmalensee's (1977) model is adapted to allow for a monopolist airline to determine the optimal network and, to set prices and the number of flights. Finally, the paper explores the effect of charging the airline for these externalities through an 'environmental' tax when it operates a hub-and-spoke network. We examine two scenarios, a. passenger-related tax and an aircraft-related tax and show the extent to which prices and the number of flights are affected by the tax.
Author
Airline Operations; Economics; Environmental Control; Numerical Analysis; Airports

19990099409 British Columbia Univ., Faculty of Commerce and Business Administration, Vancouver, British Columbia Canada
Optimal Demand for Operating Lease of Aircraft
Oum, Tae Hoon, British Columbia Univ., Canada; Zhang, Anming, City Univ. of Hong Kong, Hong Kong; Zhang, Yimin, City Univ. of Hong Kong, Hong Kong; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 26p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Operating lease of the aircraft gives the airlines flexibility in capacity management. However, airlines pay a risk premium to the leasing companies for bearing part of the risks. Therefore, the airlines face a trade-off between flexibility of capacity and higher costs. This paper develops a model for the airlines to determine their optimal mix of leased and owned capacity, taking into consideration that the demand for air transportation is uncertain and cyclical. Empirical results based on the model suggested that the optimal demand by 23 major airlines in the world would range between 40 to 60 percent of their total fleet, for the reason-

able range of premiums of operating lease. For the leasing companies, this indicates huge potential of the market given strong forecast for the growth of air transportation in the next decade.
Author
Air Transportation; Airline Operations; Commercial Aircraft; Costs; Tradeoffs; Leasing

19990099410 British Columbia Univ., Faculty of Commerce and Business Administration, Vancouver, British Columbia Canada
Aircraft-Leasing Industry and Social Welfare
Oum, Tae Hoon, British Columbia Univ., Canada; Zhang, Anming, City Univ. of Hong Kong, Hong Kong; Zhang, Yimin, City Univ. of Hong Kong, Hong Kong; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 22p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Aircraft leasing has become an increasingly important tool for airline financing. This paper considers the effect of the aircraft-leasing market on the efficiency of the airline industry. Since the aircraft-leasing companies represent an extra layer between aircraft users and aircraft manufacturers, the leasing market adds to the costs of aircraft financing. This paper shows that the aircraft-leasing market serves a valuable social function by improving allocative efficiency of the airlines. The leasing market allows the airlines opportunity to adjust capacity so that the shadow value of capacity can be aligned with the cost of capacity. This is difficult to achieve without the leasing market due to the substantial delivery lag with the aircraft manufacturers. As a result, use of aircraft leasing may increase the expected profits of the airlines even though the airlines are paying higher capacity costs. The paper also points out that the existence of the aircraft-leasing market may change the aggregate demand for aircraft by the airlines. Specifically, if the shadow value of capacity is nonlinear in capacity, then the aggregate of the optimal capacity of all the airlines in the absence of leasing market differs from the aggregate of the optimal capacity of all the leasing companies supplying to the airlines. This implies that simply aggregating airlines' traffic forecast could lead to erroneous order decision or production plan by the leasing companies or the aircraft manufacturers.
Author
Leasing; Commercial Aircraft; Airline Operations

19990099412 Instituto Tecnologico de Aeronautica, Sao Paulo, Brazil
Study About Operational Effects of the "Security Check-In" Implantation in Brazilian International Airports
deAlmeida, Paulo Marcos Santo, Instituto Tecnologico de Aeronautica, Brazil; Alves, Claudio Jorge Pinto, Instituto Tecnologico de Aeronautica, Brazil; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 10p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

With the growing of the air traffic, the passengers' terminals have been presenting an increase of congestion situations in the departure as in arriving processes. Such congestion can cause delays and queues, affecting the passengers perception on quality of service offered. On this aspect the airline should have a concern about the departure process that, how it's administered by its own, contribute strongly to the image of the company to its customers. Specifically for North American airlines and for some other ones with flights to the United States of America, there is the "security check-in" procedure. This procedure came from the need of these companies to protect their aircraft and their passenger from the international terrorism growing. This became a demand of FAA (Federal Aviation Administration - USA) for the aircraft destined to the United States of America. The inclusion of the "security check-in" can influence the operational performance of departure affecting the user perception in relation to the airline offered. In this group of airlines American Airlines is included. The verification of the occurrence of deficiencies in the departure components can be done through the comparison among the performance patterns used by the airline and the measured ones. This is done in this work monitoring the process of "security check-in" and "check-in" through the mensuration of important parameters, as time of processing and number of people in queue.
Author
Research; Airline Operations; Airports; Civil Aviation; Passengers; Security

19990100640 FDC/NYMA, Inc., Aerospace Sector, Hampton, VA USA
The Typical General Aviation Aircraft *Final Report*
Turnbull, Andrew, FDC/NYMA, Inc., USA; September 1999; 32p; In English
Contract(s)/Grant(s): NAS1-96013; RTOP 538-11-22-01
Report No.(s): NASA/CR-1999-209550; NAS 1.26:209550; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The reliability of General Aviation aircraft is unknown. In order to "assist the development of future GA reliability and safety requirements", a reliability study needs to be performed. Before any studies on General Aviation aircraft reliability begins, a defi-

nition of a typical aircraft that encompasses most of the general aviation characteristics needs to be defined. In this report, not only is the typical general aviation aircraft defined for the purpose of the follow-on reliability study, but it is also separated, or "sifted" into several different categories where individual analysis can be performed on the reasonably independent systems. In this study, the typical General Aviation aircraft is a four-place, single engine piston, all aluminum fixed-wing certified aircraft with a fixed tricycle landing gear and a cable operated flight control system. The system breakdown of a GA aircraft "sifts" the aircraft systems and components into five categories: Powerplant, Airframe, Aircraft Control Systems, Cockpit Instrumentation Systems, and the Electrical Systems. This breakdown was performed along the lines of a failure of the system. Any component that caused a system to fail was considered a part of that system.
Author
General Aviation Aircraft; Aircraft Reliability; Component Reliability; Aircraft Safety; System Failures

19990101882 Army Safety Center, Fort Rucker, AL USA
FLIGHTFAX: Army Aviation Risk-Management Information. June 1999, Volume 27, Number 6
Jun. 1999; 13p; In English
Report No.(s): AD-A364895; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This document contains information concerning Army aviation safety, tree strike accident investigations, and aviation accident prevention.
DTIC
Aircraft Accidents; Accident Prevention; Aircraft Safety

19990103936 National Transportation Safety Board, Washington, DC USA
National Transportation Safety Board Transportation Initial Decisions and Orders and Board Opinions and Orders Adopted and Issued during the Month of June 1999
Jun. 1999; 206p; In English
Report No.(s): PB99-916706; NTSB/IDBOO-99/06; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy
    This publication contains all Judges Initial Decisions and Board Opinions and Orders in Safety and Seaman Enforcement Cases for June 1999.
NTIS
Safety Management; Air Transportation

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control. For related information see also 17 Space Communications, Spacecraft Communications, Command and Tracking and 32 Communications and Radar.

19990102206 NASA Marshall Space Flight Center, Huntsville, AL USA
1998 Guidance, Navigation, and Control Highlights
Polites, Michael E., NASA Marshall Space Flight Center, USA; December 1998; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
    This article summarizes the highlights of recent events and developments in guidance, navigation, and control in space, aircraft, and weapons. The article is about 1,200 words long. Information for the article was collected from other NASA Centers, DoD, and industry. All information collected was previously cleared by the originating organizations. Information for the article was also gathered from Aviation Week and Space Technolo2y, Space News, and similar sources.
Author
Guidance (Motion); Spacecraft Control; Navigation; Product Development

19990102903 NASA Marshall Space Flight Center, Huntsville, AL USA
Recent Events in Guidance, Navigation, and Control Highlights
Polites, Michael E., NASA Marshall Space Flight Center, USA; 1999; In English; 1999 Guidance, Navigation and Control, Aug. 1999, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This article summarizes the highlights of recent events and developments in guidance, navigation, and control in space, aircraft, and weapons. This article is about 3,600 words long. Information for the article was collected from other NASA Centers, DoD, and industry. All information was previously cleared by the originating organizations. Information for the article was also gathered from Aviation Week and Space Technology, Space News, and similar sources.
Author
Guidance (Motion); Spacecraft Control; Air Navigation; Space Navigation; Flight Control

19990103019 NASA Marshall Space Flight Center, Huntsville, AL USA
Recent Events in Guidance, Navigation, and Control
Polites, Michael E., NASA Marshall Space Flight Center, USA; [1998]; In English; Guidance, Navigation, and Control, 10-12 Aug. 1998, Boston, MA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

This article summarizes the highlights of recent events and developments in guidance, navigation, and control in space, aircraft, and weapons. Information for the article was collected from other NASA Centers, DoD, and industry. All information collected was previously cleared by the originating organizations. Information for the article was also gathered from Aviation Week and Space Technology, Space News, and similar sources.
Author
Aerospace Engineering; Guidance (Motion); Navigation; Spacecraft Control

19990103599 NASA Goddard Space Flight Center, Greenbelt, MD USA
Autonomous Navigation Using Celestial Objects
Folta, David, NASA Goddard Space Flight Center, USA; Gramling, Cheryl, NASA Goddard Space Flight Center, USA; Leung, Dominic, Computer Sciences Corp., USA; Belur, Sheela, Computer Sciences Corp., USA; Long, Anne, Computer Sciences Corp., USA; 1999; 3p; In English; 1999 Astrodynamics Specialists, Aug. 1999, Girdwood, USA; Sponsored by American Astronautical Society; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In the twenty-first century, National Aeronautics and Space Administration (NASA) Enterprises envision frequent low-cost missions to explore the solar system, observe the universe, and study our planet. Satellite autonomy is a key technology required to reduce satellite operating costs. The Guidance, Navigation, and Control Center (GNCC) at the Goddard Space Flight Center (GSFC) currently sponsors several initiatives associated with the development of advanced spacecraft systems to provide autonomous navigation and control. Autonomous navigation has the potential both to increase spacecraft navigation system performance and to reduce total mission cost. by eliminating the need for routine ground-based orbit determination and special tracking services, autonomous navigation can streamline spacecraft ground systems. Autonomous navigation products can be included in the science telemetry and forwarded directly to the scientific investigators. In addition, autonomous navigation products are available onboard to enable other autonomous capabilities, such as attitude control, maneuver planning and orbit control, and communications signal acquisition. Autonomous navigation is required to support advanced mission concepts such as satellite formation flying. GNCC has successfully developed high-accuracy autonomous navigation systems for near-Earth spacecraft using NASA's space and ground communications systems and the Global Positioning System (GPS). Recently, GNCC has expanded its autonomous navigation initiative to include satellite orbits that are beyond the regime in which use of GPS is possible. Currently, GNCC is assessing the feasibility of using standard spacecraft attitude sensors and communication components to provide autonomous navigation for missions including: libration point, gravity assist, high-Earth, and interplanetary orbits. The concept being evaluated uses a combination of star, Sun, and Earth sensor measurements along with forward-link Doppler measurements from the command link carrier to autonomously estimate the spacecraft's orbit and reference oscillator's frequency. to support autonomous attitude determination and control and maneuver planning and control, the orbit determination accuracy should be on the order of kilometers in position and centimeters per second in velocity. A less accurate solution (one hundred kilometers in position) could be used for acquisition purposes for command and science downloads. This paper provides performance results for both libration point orbiting and high Earth orbiting satellites as a function of sensor measurement accuracy, measurement types, measurement frequency, initial state errors, and dynamic modeling errors.
Author
Automatic Control; Autonomous Navigation; Celestial Bodies; Satellite Orbits; Space Navigation; Algorithms

19990105719 Air Force Scientific Advisory Board, Washington, DC USA
Global Air Navigation Systems, Volume 2, Detailed Findings *Final Report, Jan.-Dec. 1997*
McCall, G.; Sep. 1998; 169p; In English
Report No.(s): AD-A367419; SAB-TR-97-02-VOL-2; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

This report presents the detailed findings of the 1997 Air Force Scientific Advisory Board (SAB) study on Global Air Navigation Systems (GANS). Major issues and requirements for GANS are discussed, including capabilities vs. equipment, the impact of GATM noncompliance, technology needs, proposed acquisition and management strategy with the Air Force in leadership role, ground and future service provider infrastructure including ATC, international aspects, liability, demonstrations, datalinks, GPS/INS technical information, and airspace deconfliction implications for the Department of Defense (DoD). Changes in the global civil airspace architecture will necessitate changes in Air Force equipment and procedures. The GANS Study attempted to identify, define, and categorize the modifications and additions necessary for DoD aircraft and ground systems to operate in the new environment in terms of urgency and utility. Needs and possibilities for navigation systems to be used by the USAF of the 21st century were examined. Departure, en route, and landing procedures and requirements were studied. New GATM requirements will affect space and ground systems as well as aircraft.
DTIC

Air Navigation; Air Traffic Control; Global Positioning System; Civil Aviation

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology. For related information see also 18 Spacecraft Design, Testing and Performance and 39 Structural Mechanics. For land transportation vehicles see 85 Urban Technology and Transportation.

19990100658 NASA Langley Research Center, Hampton, VA USA
Airbreathing Hypersonic Vision-Operational-Vehicles Design Matrix
Hunt, James L., NASA Langley Research Center, USA; Pegg, Robert J., NASA Langley Research Center, USA; Petley, Dennis H., NASA Langley Research Center, USA; [1999]; 14p; In English; 1999 World Aviation, 19-21 Oct. 1999, San Francisco, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): Rept-1999-01-5515; Copyright; Avail: Issuing Activity, Hardcopy

This paper presents the status of the airbreathing hypersonic airplane and space-access vision-operational-vehicle design matrix, with emphasis on horizontal takeoff and landing systems being studied at Langley; it reflects the synergies and issues, and indicates the thrust of the effort to resolve the design matrix including Mach 5 to 10 airplanes with global-reach potential, pop-up and dual-role transatmospheric vehicles and airbreathing launch systems. The convergence of several critical systems/technologies across the vehicle matrix is indicated. This is particularly true for the low speed propulsion system for large unassisted horizontal takeoff vehicles which favor turbines and/or perhaps pulse detonation engines that do not require LOX which imposes loading concerns and mission flexibility restraints.
Author

Air Breathing Engines; Air Breathing Boosters; Booster Rocket Engines; Engine Design; Spacecraft Design; Aircraft Design; Design Analysis; Transatmospheric Vehicles

19990101885 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. fuer Flugmechanik, Brunswick, Germany
Identification of Non-Linear Derivative Models from Bo 105 Flight Test Data
Rohlfs, M., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; The Aeronautical Journal; Jan. 1998; Volume 102, No. 1011, pp. 1-8; In English; 22nd; European Rotorcraft Forum, Sep. 1996, Brighton, UK; Sponsored by Royal Aeronautical Society, UK; See also 19990101884
Report No.(s): Paper 2232; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This paper describes the results of a study focusing on the possibility of identifying nonlinear helicopter models in the time domain. In recent years identification techniques working mainly in the frequency domain were applied to estimate the parameters in helicopter models. Recently, the time domain identification method of DLR was improved to allow the identification of fully nonlinear models. to investigate the applicability of this method to helicopters a nonlinear derivative model with explicit equations for the individual blade flapping angles was formulated. In comparison to the linear derivative models nonlinear models are physically more realistic and are not restricted by small perturbation assumptions. Although, a large number of unknowns had to be determined, a nonlinear model was successfully identified.
Author

Frequencies; Helicopters; Identifying; Nonlinearity; Time Domain Analysis; Mathematical Models

19990101886 Queen Mary and Westfield Coll., Dept. of Engineering, London, UK

On the Equations of Motion for an Aircraft with an Internal Moving Load which is then Dropped

Bernstein, L., Queen Mary and Westfield Coll., UK; The Aeronautical Journal; Jan. 1998; Volume 102, No. 1011, pp. 9-24; In English; See also 19990101884

Report No.(s): Paper 2330; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Equations of motion have been developed for the situation in which a substantial load, carried internally by an aircraft, is drawn along a ramp by an retraction parachute and is then dropped. The motion of the load is assumed to remain in the plane of symmetry. The perturbations to the aircraft motion are assumed to be small so that the equations can be linearized following the representation of the aerodynamic out of balance forces using conventional aerodynamic derivatives. The resulting system of six ordinary differential equations consists of the four normally associated with the longitudinally perturbed motion of the aircraft (slightly modified by the reaction forces due to the load), together with two describing the motion of the load. Numerical solutions are presented for a generic aircraft, the investigation examining the effects of a number of different parameters such as the ratio of the mass of the load to that of the aircraft, the length and angle of the ramp, the friction between the load and the ramp and the direction of the parachute extraction force. In addition the effects of employing various control strategies to limit the disturbed motion have also been computed. It was found that the acceleration of the load relative to the aircraft was sensibly constant. In the absence of any resetting of the controls (elevators and throttle), the disturbances computed exceeded those for which the linearizations justified. When the controls were reset, either as the load began to move or as it was jettisoned, to the trim values appropriate to the unloaded aircraft flying at the same speed, the disturbances were reduced, but remained large, the phugoid mode being dominant.. the incorporation of various kinds of feedback from the disturbance variables to the elevator was also investigated and a successful control strategy was identified, that limited the perturbations and minimized the steady-state errors in airspeed and angle of climb

Author

Aerodynamic Balance; Numerical Analysis; Perturbation; Climbing Flight; Mass Distribution; Airdrops; Equations of Motion; Feedback; Dynamic Characteristics

19990102880 NASA Wallops Flight Facility, Wallops Island, VA USA

A Spreadsheet Simulation Tool for Terrestrial and Planetary Balloon Design

Raquea, Steven M., NASA Wallops Flight Facility, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

During the early stages of new balloon design and development, it is necessary to conduct many trade studies. These trade studies are required to determine the design space, and aid significantly in determining overall feasibility. Numerous point designs then need to be generated as details of payloads, materials, mission, and manufacturing are determined. to accomplish these numerous designs, transient models are both unnecessary and time intensive. A steady state model that uses appropriate design inputs to generate system-level descriptive parameters can be very flexible and fast. Just such a steady state model has been developed and has been used during both the MABS 2001 Mars balloon study and the Ultra Long Duration Balloon Project. Using Microsoft Excel's built-in iteration routine, a model was built. Separate sheets were used for performance, structural design, materials, and thermal analysis as well as input and output sheets. As can be seen from figure 1, the model takes basic performance requirements, weight estimates, design parameters, and environmental conditions and generates a system level balloon design. Figure 2 shows a sample output of the model. by changing the inputs and a few of the equations in the model, balloons on earth or other planets can be modeled. There are currently several variations of the model for terrestrial and Mars balloons, as well there are versions of the model that perform crude material design based on strength and weight requirements. to perform trade studies, the Visual Basic language built into Excel was used to create an automated matrix of designs. This trade study module allows a three dimensional trade surface to be generated by using a series of values for any two design variables. Once the fixed and variable inputs are defined, the model automatically steps through the input matrix and fills a spreadsheet with the resulting point designs. The proposed paper will describe the model in detail, including current variations. The assumptions, governing equations, and capabilities will be addressed. Detailed examples of the model in practice will also be used.

Author

Balloons; Design Analysis; Structural Design; Tables (Data); Technology Assessment

19990103068 National Aerospace Lab., Flight Div., Tokyo, Japan

Technical Report of National Aerospace Laboratory. Navigation, Guidance, and Control Law and Planning of Flight Experiment for Scaled Supersonic Experimental Airplane, First Report

Suzuki, H.; Jan. 1999; 26p; In Japanese; Portions of this document are not fully legible

Report No.(s): PB99-169575; NAL-TR-1377; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

As part of international joint technology development efforts for second-generation supersonic transport, two types of scaled supersonic experimental airplanes, un-powered ones, are under development at the National Aerospace Laboratory (NAL). The results of design of the navigation, guidance, and control law for the un-powered experimental airplane launched by a rocket booster are presented in this paper. The flight capability is assessed based on flight simulations with the designed control system. It is verified that the design control system has the ability to perform the flight plan within first-order accuracy for flight conditions. A flight plan of higher-order accuracy is also proposed based on these results.
NTIS
Control Theory; Flight Plans; Aircraft Guidance; Air Navigation

19990103152 NASA Marshall Space Flight Center, Huntsville, AL USA
Lifting Body Flight Vehicles
Barret, Chris, NASA Marshall Space Flight Center, USA; 1998; 1p; In English, 16-20 Jun. 1998, Houston, TX, USA; Sponsored by Society of Women Engineers; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

NASA has a technology program in place to build the X-33 test vehicle and then the full sized Reusable Launch Vehicle, VentureStar. VentureStar is a Lifting Body (LB) flight vehicle which will carry our future payloads into orbit, and will do so at a much reduced cost. There were three design contenders for the new Reusable Launch Vehicle: a Winged Vehicle, a Vertical Lander, and the Lifting Body(LB). The LB design won the competition. A LB vehicle has no wings and derives its lift solely from the shape of its body, and has the unique advantages of superior volumetric efficiency, better aerodynamic efficiency at high angles-of-attack and hypersonic speeds, and reduced thermal protection system weight. Classically, in a ballistic vehicle, drag has been employed to control the level of deceleration in reentry. In the LB, lift enables the vehicle to decelerate at higher altitudes for the same velocity and defines the reentry corridor which includes a greater cross range. This paper outlines our LB heritage which was utilized in the design of the new Reusable Launch Vehicle, VentureStar. NASA and the U.S. Air Force have a rich heritage of LB vehicle design and flight experience. Eight LB's were built and over 225 LB test flights were conducted through 1975 in the initial LB Program. Three LB series were most significant in the advancement of today's LB technology: the M2-F; HL-1O; and X-24 series. The M2-F series was designed by NASA Ames Research Center, the HL-10 series by NASA Langley Research Center, and the X-24 series by the Air Force. LB vehicles are alive again today.
Author
Hypersonic Speed; Lifting Bodies; Reusable Launch Vehicles; X-33 Reusable Launch Vehicle; Aerodynamic Configurations

19990103348 General Accounting Office, National Security and International Affairs Div., Washington, DC USA
UNMANNED AERIAL VEHICLES: DoD's Demonstration Approach Has Improved Project Outcomes
Aug. 30, 1999; 16p; In English; Report to the Secretary of Defense.
Report No.(s): AD-A367307; GAO/NSIAD-99-33; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense (DOD) needs Unmanned Aerial Vehicles (UAV) for surveillance and reconnaissance missions. Since the end of the Vietnam War, DOD began at least nine UAV acquisition programs that were later canceled, spending $4 billion in the process. (See app. I.) In 1994, as part of its acquisition reform efforts, DOD adopted an Advanced Concept Technology Demonstration (ACTD) strategy for assessing UAVs. 2 We reviewed current UAV projects to determine whether DOD's strategy of conducting ACTDs before developing and producing UAVs provides an improved knowledge base for making acquisition decisions. DOD has completed ACTD projects for the Predator and Outrider UAV systems and has an ongoing ACTD for the Global Hawk UAV. DOD terminated a fourth UAV project, DarkStar, before its ACTD was completed. The ACTD strategy of focusing on mature technology and proving military utility before committing to a UAV has expanded DOD's knowledge base, allowing it to make some well informed acquisition decisions. For example, when DOD began the Predator ACTD in 1994, the Predator was considered technologically mature because its design was based on an existing UAV the Gnat 750. Nevertheless, DOD still required that the Predator's performance be demonstrated. Prototypes of the Predator were deployed in Bosnia in 1995 and 1996, allowing users to determine whether the UAV would meet their needs. Only after this performance data was gathered and analyzed in 1997 was DOD willing to formally commit to the UAV's acquisition.3 In another case, the ACTD for the DarkStar UAV DOD
DTIC
Government Procurement; Military Technology; Unmanned Spacecraft; Military Spacecraft

19990103355 Air Force Academy, CO USA
F-16 Uninhabited Air Combat Vehicles
Thompson, Kenneth E.; Apr. 01, 1998; 82p; In English
Report No.(s): AD-A367242; AU/ACSC/282/1998-04; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The US Air Force is Actively pursuing unmanned aerial vehicle programs for surveillance and reconnaissance missions. However, the Air Force has not funded any substantial research into bomb or missile carrying "lethal" UAV's, despite the recommendations of the USAF scientific board's New World Vistas, DARPA, and the Air Force 2025 project. With budget constraints and a reluctant to transition to an unmanned combat force, new advance technologies UCAVs are decades from operational status. by modifying the multi-role F-16 fighter into an unmanned aircraft, the USAF can quickly provide a cost-effective interim UCAV. Lockheed Martin has suggested the modification of "boneyard" non-flying F-16 A-models into UCAVs. An investigation of this idea yielded several limitations and concerns that led to the formulation of an alternative F-16 UCAV proposal. Many of the limitations, concerns and costs associated with the Lockheed Martin F-16A proposal are eliminated or reduced by modifying currently flying block 40 and 50 F-16Cs and operational squadrons. With the addition of remote control equipment, a few squadron jets are converted into "dual role" aircraft. The selected dual role F-16Cs can continue to fly as normal "manned" aircraft or, if needed as unmanned remotely piloted UCAVs. Converting a few block 40 LANTIRN laser targeting pod equipped and block 50 Harm targeting system equipped F-16Cs in operational squadrons to dual role UCAVs will quickly provide a cost effective and capable interim unmanned military option. With low modification costs, no new infrastructure requirements, and no need for additional pilots or support personnel, the USAF should immediately start the developments, testing and conversion of a few F-16Cs into dual role UCAVs. As an interim unmanned military option, the F-16C UCAV will provide valuable insights and lessons or future advanced technology UCAV development and operations.
DTIC
F-16 Aircraft; Pilotless Aircraft; Remotely Piloted Vehicles

19990103619 Naval Surface Warfare Center, Carderock Div., Bethesda, MD USA
Dynamic Effects on Propeller Blade Section Lift, Drag, and Pitching Moment Coefficients *Final Report*
Shen, Young T.; Fuhs, Donald; Aug. 1999; 62p; In English
Contract(s)/Grant(s): Proj-R2332
Report No.(s): AD-A367313; CRDKNSWC/HD-1205-05; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
      The Propeller Force Module (PFM) uses the blade element/momentum theory to predict propeller forces during maneuvers. A typical inflow angle distribution is studied. The blade sections will encounter spatial and temporal variations in angles of attack. Theories to calculate unsteady effects on section lift, drag, and pitching moment coefficients are formulated and presented in this report. Using the classic approach developed in aerodynamics, the section lift and pitching moment are expressed in circulatory and non-circulatory solutions. The non-circulatory solution is found to be a universal function independent of the type of motion. The circulatory solution depends heavily on the type of motion. In the case of ramp-up and ramp-down motions simulating blade sections experiencing angle of attack variations when maneuvering, an analytical solution is obtained for the circulatory lift. Empirical formula are developed to calculate the delay in stall angle due to unsteady motion. The classic aerodynamic theories assume the flow to be potential which give zero drag. Instead, Leishman's mathematical model assuming a loss of full suction pressure recovery at the leading edge due to viscous effect is adopted in this report to calculate the dynamic drag. The theories are compared with experimental measurements by Francis and Keesee, and by Ham and Garelick with encouraging results.
DTIC
Aerodynamic Drag; Lift; Pitch (Inclination); Pitching Moments; Predictions; Dynamic Response; Propeller Blades; Angle of Attack; Leading Edges

19990104323 NASA Dryden Flight Research Center, Edwards, CA USA
Summary of Inlet Characteristics of the F/A-18A High Alpha Research Vehicle
Walsh, Kevin, NASA Dryden Flight Research Center, USA; Steenken, William, General Electric Co., USA; Williams, John, General Electric Co., USA; July 1998; In English; 34th; Propulsion, 13-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Diskette: 1 3.5-inch DSHD diskette
Contract(s)/Grant(s): RTOP 529-31-04-00-37
Report No.(s): H-2260; AIAA Paper 98-3713; NONP-NASA-DK-1998358197; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche, Diskette
      Effects of high-angle-of-attack flight on aircraft inlet aerodynamic characteristics were investigated at NASA Dryden Flight Research Center as part of NASA's High Alpha Technology Program. The highly instrumented F/A-18A High Alpha Research Vehicle was used for this research. A newly designed inlet total-pressure rake was installed in front of the right-hand F404-GE-400 engine to measure inlet recovery and distortion characteristics. Objectives included: (1) determining the inlet total-pressure characteristics at steady high-angle-of-attack conditions; (2) assessing if inlet distortion is significantly different between rapid angle-of-attack maneuvers and corresponding steady aerodynamic conditions; (3) assessing inlet characteristics during aircraft departures; (4) providing data for developing and verifying computational fluid dynamic codes; and (5) calculating engine airflow

using four methods for comparison with a reference method. This paper describes the results obtained from this investigation. These data and the associated database were rigorously validated to establish the foundation for understanding inlet characteristics at high angle of attack.
Author
Aerodynamic Characteristics; Air Flow; Angle of Attack; Computational Fluid Dynamics; Engine Inlets; Inlet Pressure; Takeoff; Inlet Flow; Air Intakes; Turbulence; Aerodynamic Stalling

19990104609 Naval Postgraduate School, Monterey, CA USA
Design and Prototype Development of a Wireless Power Transmission System for a Micro Air Vehicle (MAV)
Vitale, Robert L.; Jun. 1999; 193p; In English
Report No.(s): AD-A367272; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

Microwave radiation at 1.0 GHz and 1.3 GHz is used to demonstrate remote powering of a micro air vehicle (MAV). Several prototype microwave rectifier systems were fabricated in microstrip using EEsof(registered) computer aided engineering (CAE) software to assist in their design. Radio frequency (RF) parameters of the rectifiers were measured on a vector network analyzer. RF-to-DC conversion efficiency was measured for several designs and with various circuit loads consisting of lumped elements and DC motors. A peak RF-to-DC conversion efficiency of 33 percent was achieved. MAV antenna designs were investigated by simulating 68 geometries using the GNEC (registered) numerical electromagnetics computer program. Two prototype MAVs were assembled, each consisting of microwave rectifier, antenna and a miniature DC motor. It was demonstrated that a 1.8-Watt, 1.3-GHz microwave signal could power the DC motor at free space distance of 30 inches from transmitting antenna to prototype MAV. Greater operating distances are proposed by using higher transmitting power and antenna gain.
DTIC
Prototypes; Electric Power Transmission; Transmission Lines; Antenna Design; Microwave Antennas; Microwaves

19990105689 Georgia Tech Research Inst., Aerospace, Transportation and Advanced Systems Lab., Atlanta, GA USA
Additional Development and Systems Analyses of Pneumatic Technology for High Speed Civil Transport Aircraft *Final Report, 6 Apr. 1998 - 5 Jul. 1999*
Englar, Robert J., Georgia Tech Research Inst., USA; Willie, F. Scott, Georgia Tech Research Inst., USA; Lee, Warren J., Georgia Tech Research Inst., USA; Oct. 03, 1999; 83p; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG1-2051; GTRI Proj. A-5676; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In the Task I portion of this NASA research grant, configuration development and experimental investigations have been conducted on a series of pneumatic high-lift and control surface devices applied to a generic High Speed Civil Transport (HSCT) model configuration to determine their potential for improved aerodynamic performance, plus stability and control of higher performance aircraft. These investigations were intended to optimize pneumatic lift and drag performance; provide adequate control and longitudinal stability; reduce separation flowfields at high angle of attack; increase takeoff/climbout lift-to-drag ratios; and reduce system complexity and weight. Experimental aerodynamic evaluations were performed on a semi-span HSCT generic model with improved fuselage fineness ratio and with interchangeable plain flaps, blown flaps, pneumatic Circulation Control Wing (CCW) high-lift configurations, plain and blown canards, a novel Circulation Control (CC) cylinder blown canard, and a clean cruise wing for reference. Conventional tail power was also investigated for longitudinal trim capability. Also evaluated was unsteady pulsed blowing of the wing high-lift system to determine if reduced pulsed mass flow rates and blowing requirements could be made to yield the same lift as that resulting from steady-state blowing. Depending on the pulsing frequency applied, reduced mass flow rates were indeed found able to provide lift augmentation at lesser blowing values than for the steady conditions. Significant improvements in the aerodynamic characteristics leading to improved performance and stability/control were identified, and the various components were compared to evaluate the pneumatic potential of each. Aerodynamic results were provided to the Georgia Tech Aerospace System Design Lab. to conduct the companion system analyses and feasibility study (Task 2) of theses concepts applied to an operational advanced HSCT aircraft. Results and conclusions from these experimental evaluations are presented herein, as are recommendations for further development and follow-on investigations. Also provided as an Appendix for reference are the basic results from the previous pneumatic HSCT investigations.
Derived from text
Pneumatics; Civil Aviation; Control Surfaces; Aerodynamic Characteristics; Wind Tunnel Tests; Canard Configurations; Supersonic Transports; Lift Augmentation; Systems Analysis

Project 708 Subproject 3; The Effect of Modern Penetrating Weapons *Final Report Sluttrapport Prosjekt 708 Delprosejekt 3: Virkningen av Moderne Penetrerende Vapen*

Sjol, Henrik, Norwegian Defence Research Establishment, Norway; Mar. 19, 1999; 35p; In Dutch; Original contains color illustrations

Due to the development of precision guided missiles, the penetration capability against stationary concrete targets becomes more important. The aim of the project was to study the penetration capacity of both existing and future KE-penetrators into concrete targets, and to examine the use of other cover materials, such as "high performance concrete" (HPC). The problem was treated in several ways. A review of existing empirical formulas for predicting the penetration depth was carried out, finding great difference between the formulas. Some penetration experiments in small scale, against targets of both normal concrete and HPC were performed, and these experiments were verified numerically by using the hydrocode Autodyn. Comparison to other experimental results were also performed. A theoretical study of penetration mechanics was carried out to give a better understanding of the problem.
Author
Weapon Systems; Missiles; Guidance (Motion); Missile Control

System Analyses of Pneumatic Technology for High Speed Civil Transport Aircraft *Final Report, 6 Apr. 1998 - 5 Jul. 1999*

Mavris, Dimitri N., Georgia Inst. of Tech., USA; Tai, Jimmy C., Georgia Inst. of Tech., USA; Kirby, Michelle M., Georgia Inst. of Tech., USA; Roth, Bryce A., Georgia Inst. of Tech., USA; Oct. 03, 1999; 134p; In English

The primary aspiration of this study was to objectively assess the feasibility of the application of a low speed pneumatic technology, in particular Circulation Control (CC) to an HSCT concept. Circulation Control has been chosen as an enabling technology to be applied on a generic High Speed Civil Transport (HSCT). This technology has been proven for various subsonic vehicles including flight tests on a Navy A-6 and computational application on a Boeing 737. Yet, CC has not been widely accepted for general commercial fixed-wing use but its potential has been extensively investigated for decades in wind tunnels across the globe for application to rotorcraft. More recently, an experimental investigation was performed at Georgia Tech Research Institute (GTRI) with application to an HSCT-type configuration. The data from those experiments was to be applied to a full-scale vehicle to assess the impact from a system level point of view. Hence, this study attempted to quantitatively assess the impact of this technology to an HSCT. The study objective was achieved in three primary steps: 1) Defining the need for CC technology; 2) Wind tunnel data reduction; 3) Detailed takeoff/landing performance assessment. Defining the need for the CC technology application to an HSCT encompassed a preliminary system level analysis. This was accomplished through the utilization of recent developments in modern aircraft design theory at Aerospace Systems Design Laboratory (ASDL). These developments include the creation of techniques and methods needed for the identification of technical feasibility show stoppers. These techniques and methods allow the designer to rapidly assess a design space and disciplinary metric enhancements to enlarge or improve the design space. The takeoff and landing field lengths were identified as the concept "show-stoppers". Once the need for CC was established, the actual application of data and trends was assessed. This assessment entailed a reduction of the wind tunnel data from the experiments performed by Mr. Bob Englar at the GTRI. Relevant data was identified and manipulated based on the required format of the analysis tools utilized. Propulsive, aerodynamic, duct sizing, and vehicle sizing investigations were performed and information supplied to a detailed takeoff and landing tool, From the assessments, CC was shown to improve the low speed performance metrics, which were previously not satisfied. An HSCT with CC augmentation does show potential for full-scale application. Yet, an economic assessment of an HSCT with and without CC showed that a moderate penalty was incurred from the increased RDT&E costs associated with developing the CC technology and slight increases in empty weight.
Derived from text
Pneumatics; Civil Aviation; Circulation Control Airfoils; Aircraft Design; Technology Utilization; Supersonic Transports; Feasibility Analysis; Aircraft Performance; Data Reduction

Includes cockpit and cabin display devices; and flight instruments. For related information see also 19 Spacecraft Instrumentation and 35 Instrumentation and Photography.

19990102209 NASA Marshall Space Flight Center, Huntsville, AL USA
1998 Digital Avionics Highlights
Polites, Michael E., NASA Marshall Space Flight Center, USA; December 1998; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This article summarizes the highlights of recent events and developments in digital avionics in space, aircraft, and weapons. The article is about 1,200 words long. Information for the article was collected from members of the Digital Avionics Technical Committee of the American Institute of Aeronautics and Astronautics. This information was previously cleared by the members' parent organization. Information for the article was also gathered from Aviation Week and Space Technology and similar sources.
Author
Avionics; Summaries

19990102859 NASA Marshall Space Flight Center, Huntsville, AL USA
Application of Reconfigurable Avionics for the Bantam Launch Vehicle
Wallace, Shawn, NASA Marshall Space Flight Center, USA; Wilkerson, DeLisa, NASA Marshall Space Flight Center, USA; 1999; In English; 18th; Digital Avionics Systems, 23-29 Oct. 1999, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The modern market is placing increasing pressure on launch costs. This is particularly true for small university science payloads, where the cost of the experiment itself is relatively low, and the launch frequency is potentially very high. It is the stated goal of the Bantam Program to dramatically reduce the costs of launching this class of payloads. This is a goal that will require that the avionics not only be reduced in production costs, but also in maintenance and operation costs, because the Bantam vehicle is envisioned as a reusable launch system. However, the costs of avionics is a relatively small fraction of the overall cost of launching a payload, and a simple reduction in the avionics costs will not immediately realize the necessary gains. Instead, to reduce the total system launch costs, it is also necessary to improve avionics performance. Only by reducing weight, volume, and power, while enhancing computational capability can the avionics be used to address the system-level cost reduction requirements. The National Aeronautics and Space Administration is currently pursuing technology development tasks, in order to support the Bantam requirements. One technology task is to develop a low-cost, high-performance reconfigurable avionics core unit. In addition to providing low cost and high performance, the use of reconfigurability will be used to explore the options of accommodating multiple launch configurations, and addressing such areas as redundancy management, single-event upset immunity, and low maintenance. This paper will address how emerging developments in reconfigurable avionics can be used to meet these challenges.
Author
Avionics; Cost Reduction; Costs; Launch Costs; NASA Programs; Reusable Spacecraft; Configuration Management

19990102985 Institute for Human Factors TNO, Soesterberg, Netherlands
Advanced Cockpit Displays for Target Acquisition *Final Report Geavanceerde cockpit displays t.b.v. detectie en identificatie van doelen*
deVries, S. C., Institute for Human Factors TNO, Netherlands; vanBreda, L., Institute for Human Factors TNO, Netherlands; Bakker, N. H., Institute for Human Factors TNO, Netherlands; Apr. 14, 1999; 40p; In English
Contract(s)/Grant(s): A95/KLu/341; TNO Proj. 788.1
Report No.(s): TD-99-0033; TM-99-A028; Copyright; Avail: Issuing Activity, Hardcopy

In a flight simulator experiment the use of various tactical displays in a target search and identify task was examined Four display conditions were investigated: no tactical information, tactical information on a Head Down Display (HDD), tactical information on a HDD and on a Head Up Display (HUD), and tactical information on a HDD and on a Head Mounted Display (HMD). The scenarios used (flying a route indicated by a 'tunnel-in-the-sky' display with targets close to this route) did not exploit the full potential of the HMD. They were chosen to enable fair comparison of the displays. The results show that target detection and identification accuracy is slightly lower when the tactical displays are used. However, targets were detected at much larger distances. This is an indication that the tactical displays, and especially the HMD, enabled the pilots to report their detections considerably earlier than in the absence of tactical information. Flying performance with the HMD was less than without HMD, though. A probable cause is the visual interference of the HMD symbology with other avionics. An alternative explanation is that the HMD

enabled the pilots to acquire tactical information without looking in the cockpit, giving more time for targets searching. This means that they had less time to keep an eye on the route display, leading to larger course deviations.
Author
Cockpits; Display Devices; Target Acquisition; Research

19990102999 National Aerospace Lab., Flight Div., Tokyo, Japan
Cockpit Procedural Advisory System Utilizing Flight Phase Estimation
Tanaka, K.; Funabiki, K.; Muraoka, K.; Jan. 1999; 30p; In Japanese; Portions of this document are not fully legible
Report No.(s): PB99-164949; NAL-TR-1381; Copyright; Avail: National Technical Information Service (NTIS), Hardcopy
    This study deals with a proposed advisory display against cockpit procedural deviations by using autonomously estimated flight phases. Advisory systems such as a landing gear horn are of interest in this study as reactive means to protect from the consequences of slips or mistakes. The proposed system provided advisory information regarding control devices and switches critical in each flight phase. to this end, the flight phase at each instant was estimated by using the limitations of transitions from one flight phase to another. The system was implemented in a flight simulator of a glass cockpit environment, where advisory information was presented to flight crew members in an integrated altering display. An operational simulation beginning from cockpit preparations to engine shutdown was conducted, and showed that the advisory system functioned against procedural deviations appropriately and timely. However, it was found that the flight phase transition needs to be improved after a missed approach, and that the display information needs to be integrated with the existing warning system. Potential implementation of a proposed system in a future warning system or a future flight management system was suggested.
NTIS
Cockpits; Flight Management Systems; Flight Instruments; Flight Control; Display Devices

19990105883 NASA Dryden Flight Research Center, Edwards, CA USA
Flush Airdata Sensing (FADS) System Calibration Procedures and Results for Blunt Forebodies
Cobleigh, Brent R., NASA Dryden Flight Research Center, USA; Whitmore, Stephen A., NASA Dryden Flight Research Center, USA; Haering, Edward A., Jr., NASA Dryden Flight Research Center, USA; Borrer, Jerry, NASA Johnson Space Center, USA; Roback, V. Eric, NASA Langley Research Center, USA; November 1999; 32p; In English; 9th; Space Planes and Hypersonic Systems and Technologies, 1-5 Nov. 1999, Norfolk, VA, USA
Contract(s)/Grant(s): RTOP 242-33-02-00-23
Report No.(s): NASA/TP-1999-209012; NAS 1.60:209012; H-2379; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    Blunt-forebody pressure data are used to study the behavior of the NASA Dryden Flight Research Center flush airdata sensing (FADS) pressure model and solution algorithm. The model relates surface pressure measurements to the airdata state. Spliced from the potential flow solution for uniform flow over a sphere and the modified Newtonian impact theory, the model was shown to apply to a wide range of blunt-forebody shapes and Mach numbers. Calibrations of a sphere, spherical cones, a Rankine half body, and the F-14, F/A-18, X-33, X-34, and X-38 configurations are shown. The three calibration parameters are well-behaved from Mach 0.25 to Mach 5.0, an angle-of-attack range extending to greater than 30 deg, and an angle-of-sideslip range extending to greater than 15 deg. Contrary to the sharp calibration changes found on traditional pitot-static systems at transonic speeds, the FADS calibrations are smooth, monotonic functions of Mach number and effective angles of attack and sideslip. Because the FADS calibration is sensitive to pressure port location, detailed measurements of the actual pressure port locations on the flight vehicle are required and the wind-tunnel calibration model should have pressure ports in similar locations. The procedure for calibrating a FADS system is outlined.
Author
Procedures; Calibrating; Forebodies; Mathematical Models; Algorithms; Potential Flow; Pressure Measurement; Newton Theory

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft. For related information see also 20 Spacecraft Propulsion and Power, 28 Propellants and Fuels, and 44 Energy Production and Conversion.

19990101888 Cranfield Univ., School of Mechanical Engineering, Bedford, UK
Variable Cycle Jet Engines for a Mach 2.7 Supersonic Civil Transport
Aleid, L., Cranfield Univ., UK; Pilidis, P., Cranfield Univ., UK; The Aeronautical Journal; Jan. 1998; Volume 102, No. 1011, pp. 31-36; In English; See also 19990101884
Report No.(s): Paper 2352; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
        The aim of the work outlined in this paper is to compare three different variable cycle jet engine concepts for future Supersonic Transports (SST)'s. These engines are: the turbofan-turbojet, the mid tandem fan engine and the double bypass engine. The comparison is carried out on the basis of uninstalled and installed performance, handling and sizing issues. The preliminary analysis compares SFC, size, variable geometry, and cycle changes for each engine. The installed performance was estimated by calculating the air friction, the pre-entry and the after body drags, together with the wave drag due to the shock waves. A sizing calculation was carried out for the whole nacelle. The uninstalled and installed fuel bill for two standard missions is also estimated. These preliminary results indicate that the turbofan-turbojet and the mid-tandem fan engines are quite similar in terms of general suitability. The mid-tandem fan appears to be an attractive proposition from the point of view of sizing, however this comes with a small penalty in fuel consumption. The present double bypass engine was found to be least attractive for the application, although the differences are small.
Author
Engine Design; Supersonic Transports; Turbofan Engines; Turbojet Engines; Variable Cycle Engines; Nozzle Efficiency; Cruising Flight

19990101889 Queensland Univ., Dept. of Mechanical Engineering, Brisbane, Australia
Experiments on Cruise Propulsion with a Hydrogen Scramjet
Stalker, R. J., Queensland Univ., Australia; Paull, A., Queensland Univ., Australia; The Aeronautical Journal; Jan. 1998; Volume 102, No. 1011, pp. 37-43; In English; See also 19990101884
Contract(s)/Grant(s): NAGw-674
Report No.(s): Paper 2250; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
        Measurement of drag have been made in a shock tunnel on a simple integrated vehicle engine combination for hypersonic cruise with hydrogen scramjet propulsion. The test flow Mach number was 6.4, and the velocity was 2.45 kms(exp -1). Zero Drag, which is the necessary condition for cruise, was achieved as the equivalence ratio approached one. It was found that an analysis using established aerodynamic concept was adequate for predicting drag in the case of no combustion. When combustion occurred results of direct connect experiments provided was qualitative guide to the measured levels of drag, and indicated that thrust nozzle combustion was taking place. An heuristic analysis is used to point to the important effect this may have on propulsive lift.
Author
Supersonic Combustion Ramjet Engines; Hypersonic Flight; Cruising Flight; Hypersonic Flow; Wind Tunnel Tests; Hydrogen Fuels; Chemical Propulsion; Aerodynamic Drag

19990101890 Loughborough Univ. of Technology, Dept. of Aeronautical and Automotive Engineering and Transport Studies, UK
Studies into Hail Ingestion of Turbofan Engines using a Rotating Fan and Spinner Assembly
Pan, H., Loughborough Univ. of Technology, UK; Render, P. M., Loughborough Univ. of Technology, UK; The Aeronautical Journal; Jan. 1998; Volume 102, No. 1011, pp. 45-51; In English; See also 19990101884
Report No.(s): Paper 2254; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
        Simulated hailstones were made to impact on te rotating spinner and fan assembly of a Williams FJ44 engine. The mass distribution of ice behind the fan was determined by use of a suction tube technique. Suction was added to ensure that the tube did not affect the flow through the fan assembly. The strong air flow behind the fan meant that the ice caught by the tube melted and evaporated. this made it difficult to accurately determine the mass distribution of ice. As a result the simulated hailstones were made from a water-salt solution so that the weight of salt residue could be measured after the water had evaporated, and hence the amount of ice caught was determined. A parametric study into the hail ingestion characteristics of the fan assembly was carried out. The parameters studied included the radial position of the impact point, the rotational speed of the fan and the position of the

splitter between the core engine and bypass duct. The results showed that the impact position had a major effect on the overall ice distribution, which was determined by the combination of blade geometry at the impact point and the rotational speed. The splitter position was shown to have a significant effect on the amount of ice passing into the bypass duct.
Author
Hail; Ingestion (Engines); Rotation; Spinners; Turbofan Engines; Splitting

19990102970 Research and Technology Organization, Applied Vehicle Technology Panel, Neuilly-sur-Seine, France
Planar Optical Measurement Methods for Gas Turbine Components *Methodes de Mesure Optiques Planaires Pour Organes de Turbomoteurs*
September 1999; 148p; In English, 16-17 Sep. 1999, Cranfield, Cleveland, OH, UK, USA; See also 19990102971 through 19990102977; Original contains color illustrations
Report No.(s): RTO-EN-6; AC/323(AVT)TP/20; ISBN 92-837-1019-3; Copyright Waived; Avail: CASI; A07, Hardcopy; A02, Microfiche

This lecture series covers the recent advances of planar optical measurement techniques with respect to their applicability to gas turbine component tests. During the last years much progress has been achieved in various known techniques, and new methods have been developed from which a significant increase of the experimental output of propulsion tests and therefore remarkable cost reduction can be expected. to bring this status into the knowledge of the propulsion specialists is the aim of this lecture series.Its theme is focused on laser measurement methods for the analysis of the internal flow and reaction processes in propulsion engines. It will address techniques for the measurement of flow velocity, flow density, pressure, temperature and species concentration. Only those methods are introduced which are far enough developed to be applicable to the rough test conditions of propulsion experiments. The course will inform the audience about the fundamentals of the advanced measurement techniques, as well as demonstrate their use in the context of practical applications. The material in this publication was collected from the research centers of the different NATO nations. It will transfer to the propulsion engineers in a condensed manner the information of the newest capabilities of modern test techniques thus providing the knowledge base for tomorrow's measurement instrumentation of propulsion test facilities. NATO's specific interest in sponsoring this event is based on the requirement for engines of extreme performance characteristics which cannot be realised without further improvements of both CFD and measurement technologies.
Author
Conferences; Flow Measurement; Flow Velocity; Gas Turbine Engines; Optical Measurement

19990102971 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Propulsion Technology, Cologne, Germany
Capabilities of Optical Point Measurement Techniques with Respect to Aero Engine Application
Schodl, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 1-1 - 1-15; In English; See also 19990102970; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Concerning the further development of gas turbine engines advances of the aero-thermodynamic design can he achieved most efficiently by co-operative efforts aimed at the improvement of both the numerical simulation methods and the experimental test and measurement techniques. Rapid development ot numerical capability is accompanied with increasing demands on experimental data. In this context significant instrumentation research efforts are being conducted to develop the needed mea.surement technologies. In this paper an overview about the current capabilities of point measurement techniques as LDA, PDA, L2F, CARS under turbomachinery test conditions is pre.sented. Three component laser velocimetry is treated to a great extend pointing out both examples of successful measurements with detailed flow information and in which way application related problems were solved. Examples of successful applications of CARS thermometry to jet engine combustors are also given together with an estimation of its application limits. The paper concludes with an evaluation of the power ot point measurement techniques in comparison to planar techniques
Author
Laser Anemometers; Laser Doppler Velocimeters; Optical Measurement; Temperature Measurement; Gas Turbine Engines; Jet Engines; Procedures

19990102972 NASA Glenn Research Center, Cleveland, OH USA
Application of Digital Particle Imaging Velocimetry to Turbomachinery
Wernet, Mark P., NASA Glenn Research Center, USA; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 2-1 - 2-33; In English; See also 19990102970; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Digital Particle Imaging Velocimetry (DPIV) is a powerful measurement technique, which can be used as an alternative or complementary approach to Laser Doppler Velocimetry (LDV) in a wide range of research applications. The instantaneous planar velocity measurements obtained with PIV make it an attractive technique for use in the study of the complex flow fields encountered in turbomachinery. Many of the same issues encountered in the application of LDV to rotating machinery apply in the application of PIV. Techniques for optical access, light sheet delivery, CCD camera technology and particulate seeding are discussed. Results from the successful application of the PIV technique to both the blade passage region of a transonic axial compressor and the diffuser region of a high speed centrifugal compressor are presented. Both instantaneous and time-averaged flow fields were obtained. The 95% confidence intervals for the time-averaged velocity estimates were also determined. Results from the use of PIV to study surge in a centrifugal compressor are discussed. In addition, combined correlation/particle tracking results yielding super-resolution velocity measurements are presented.
Author
Correlation Detection; Particle Image Velocimetry; Velocity Measurement; Turbomachinery; Transonic Compressors; Procedures

19990102974 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. of Propulsion Technology, Cologne, Germany
Planar Quantitative Scattering Techniques for the Analysis of Mixing Processes, Shock Wave Structures and Fluid Density
Schodl, R., Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 3-1 - 3-15; In English; See also 19990102970; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Quantitative Visualization Techniques (QVT) considered in this contribution are planar measurement techniques which make use of laser light sheet and CCD-camera and deliver quantitative information of flow properties. The elastic scattering of laser light either on seeding particles or molecules is used for the measurement. Three different methods are treated: The Quantitative Light Sheet (QLS) technique for mass-fraction measurement of mixing processes, The Tracer based Shock Visualization (TSV) for the measurement of shape and structure of compression shocks and UV-Rayleigh Scattering density measurements for flow Results of measurements in a model combustor, in a transonic compressor and in a turbine cascade are presented and discussed.
Author
Procedures; Flow Characteristics; Density Measurement; Elastic Scattering

19990104277 NASA Langley Research Center, Hampton, VA USA
Jet Nozzle Having Centerbody for Enhanced Exit Area Mixing
Seiner, John M., Inventor, NASA Langley Research Center, USA; Gilinsky, Mikhail M., Inventor, NASA Langley Research Center, USA; Jul. 20, 1999; In English; Provisional US-Patent-Appl-SN-016741, filed 2 May 1996
Patent Info.: Filed 2 May 1997; NASA-Case-LAR-15518-1; US-Patent-5,924,632; US-Patent-Appl-SN-850572; US-Patent-Appl-SN-016741; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A nozzle arrangement includes a nozzle and a centerbody. The longitudinal axis of the centerbody is coaxially aligned with the nozzle. The centerbody has a free end portion shaped to create vortices in exhaust exiting the exit area. The vortices enhance mixing action in the exhaust and reduce exhaust noise while augmenting thrust.
Author
Exhaust Nozzles; Nozzle Design; Coaxial Nozzles; Noise Reduction

19990104350 Allison Engine Co., Indianapolis, IN USA
Aviation Turbine Engine Diagnostic System (ATEDS) for the OH-58D Helicopter *Final Report*
DeMott, Larry R.; Jul. 1999; 363p; In English
Contract(s)/Grant(s): DAAJ02-97-C-0014
Report No.(s): AD-A366338; EDR-18882; USAAMCOM-TR-99-D-22; No Copyright; Avail: CASI; A03, Microfiche; A16, Hardcopy

The US Army has documented the need for improved equipment and procedures to provide electronic troubleshooting/diagnostics of helicopter turbine engines. The Aviation Turbine has been initiated to address this need. A key element of the system development requires the creation of detailed, step-by-step, troubleshooting/diagnostic procedures and conversion of this data to electronic format compatible with the overall system. This report documents the activity accomplished by Rolls-Royce Allison in developing this data for application to the OH-58D Kiowa Warrior helicopter.
DTIC
Turbine Engines; Diagnosis; Helicopter Engines; Systems Engineering

19990105703 NASA Marshall Space Flight Center, Huntsville, AL USA

Overview of Current Turbine Aerodynamic Analysis and Testing at MSFC

Griffin, Lisa W., NASA Marshall Space Flight Center, USA; Hudson, Susan T., NASA Marshall Space Flight Center, USA; Zoladz, Thomas F., NASA Marshall Space Flight Center, USA; Sep. 13, 1999; 1p; In English; 10th; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

An overview of the current turbine aerodynamic analysis and testing activities at NASA/Marshall Space Flight Center (MSFC) is presented. The presentation is divided into three areas. The first area is the three-dimensional (3D), unsteady Computational Fluid Dynamics (CFD) analysis of the Fastrac turbine. Results from a coupled nozzle, blade, and exit guide vane analysis and from an uncoupled nozzle and coupled blade and exit guide vane will be presented. Unsteady pressure distributions, frequencies, and exit profiles from each analysis will be compared and contrasted. The second area is the testing and analysis of the Space Shuttle Main Engine (SSME) High Pressure Fuel Turbopump (HPFTP) turbine with instrumented first stage blades. The SSME HPFTP turbine was tested in air at the MSFC Turbine Test Equipment (TTE). Pressure transducers were mounted on the first stage blades. Unsteady, 3D CFD analysis was performed for this geometry and flow conditions. A sampling of the results will be shown. The third area is a status of the Turbine Performance Optimization task. The objective of this task is to improve the efficiency of a turbine for potential use on a next generation launch vehicle. This task includes global optimization for the preliminary design, detailed optimization for blade shapes and spacing, and application of advanced CFD analysis. The final design will be tested in the MSFC TTE.
Author

Turbines; Aerodynamic Characteristics; Performance Tests; Computational Fluid Dynamics; Three Dimensional Flow; Unsteady Flow; Dimensional Analysis; Design Analysis

19990105814 National Aerospace Lab., Ramjet Propulsion Research Div., Tokyo, Japan

Mach 6 Testing of a Scramjet Engine Model

Kanda, T.; Saito, T.; Kudoh, K.; Komuro, T.; Ono, F.; Jul. 1998; 32p; In Japanese; Portions of this document are not fully legible
Report No.(s): PB99-164956; NAL-TR-1364; Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

Testing of a sub-scale scramjet research engine model was carried out in the Mach 6 Ramjet Engine Test Facility of the National Aerospace Laboratory, Kakuda Research Center. With attachment of a short strut on the top wall, intensive combustion with high combustion efficiency was attained, and the engine-produced thrust canceled the drag. The flame was held in the low-velocity region around the step, even after the ignitors had been turned off. When the fuel flow rate was small, there was a different combustion mode with weak combustion and little thrust. Tangential injection of fuel inhibited intensive combustion.
NTIS

Engine Tests; Supersonic Combustion Ramjet Engines

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots. For related information see also 05 Aircraft Design, Testing and Performance.

19990100653 George Washington Univ., Joint Inst. for Advancement of Flight Sciences, Hampton, VA USA

Modeling of Longitudinal Unsteady Aerodynamics of a Wing-Tail Combination

Klein, Vladislav, George Washington Univ., USA; September 1999; 32p; In English
Contract(s)/Grant(s): NCC1-29; RTOP 522-33-11-05
Report No.(s): NASA/CR-1999-209547; NAS 1.26:209547; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aerodynamic equations for the longitudinal motion of an aircraft with a horizontal tail were developed. In this development emphasis was given on obtaining model structure suitable for model identification from experimental data. The resulting aerodynamic models included unsteady effects in the form of linear indicial functions. These functions represented responses in the lift on the wing and tail alone, and interference between those two lifting surfaces. The effect of the wing on the tail was formulated for two different expressions concerning the downwash angle at the tail. The first expression used the Cowley-Glauert approximation known-as "lag-in-downwash," the second took into account growth of the wing circulation and delay in the development of the lift on the tail. Both approaches were demonstrated in two examples using the geometry of a fighter aircraft and a large trans-

port. It was shown that the differences in the two downwash formulations would increase for an aircraft with long tail arm performing low-speed, rapid maneuvers.
Author
Unsteady Aerodynamics; Aerodynamic Characteristics; Aerodynamic Stability; Longitudinal Stability; Lift; Pitching Moments; Wind Tunnel Tests

19990103049 McGill Univ., Dept. of Electrical and Computer Engineering, Montreal, Quebec Canada
Cellular Decomposition Based Hybrid-Hierarchical Control Systems with Applications to Flight Management Systems
Final Report
Caines, P. E., McGill Univ., Canada; [1999]; 7p; In English
Contract(s)/Grant(s): NAG2-1040; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
    The work in this research project has been focused on the construction of a hierarchical hybrid control theory which is applicable to flight management systems. The motivation and underlying philosophical position for this work has been that the scale, inherent complexity and the large number of agents (aircraft) involved in an air traffic system imply that a hierarchical modelling and control methodology is required for its management and real time control. In the current work the complex discrete or continuous state space of a system with a small number of agents is aggregated in such a way that discrete (finite state machine or supervisory automaton) controlled dynamics are abstracted from the system's behaviour. High level control may then be either directly applied at this abstracted level, or, if this is in itself of significant complexity, further layers of abstractions may be created to produce a system with an acceptable degree of complexity at each level. by the nature of this construction, high level commands are necessarily realizable at lower levels in the system.
Author
Research; Control Theory; Air Traffic Control

19990103171 NASA Marshall Space Flight Center, Huntsville, AL USA
X-33 Attitude Control Using the XRS-2200 Linear Aerospike Engine
Hall, Charles E., NASA Marshall Space Flight Center, USA; Panossian, Hagop V., Boeing Co., USA; 1999; 1p; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Institute of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
    The Vehicle Control Systems Team at Marshall Space Flight Center, Structures and Dynamics Laboratory, Guidance and Control Systems Division is designing, under a cooperative agreement with Lockheed Martin Skunkworks, the Ascent, Transition, and Entry flight attitude control systems for the X-33 experimental vehicle. Test flights, while suborbital, will achieve sufficient altitudes and Mach numbers to test Single Stage to Orbit, Reusable Launch Vehicle technologies. Ascent flight control phase, the focus of this paper, begins at liftoff and ends at linear aerospike main engine cutoff (MECO). The X-33 attitude control system design is confronted by a myriad of design challenges: a short design cycle, the X-33 incremental test philosophy, the concurrent design philosophy chosen for the X-33 program, and the fact that the attitude control system design is, as usual, closely linked to many other subsystems and must deal with constraints and requirements from these subsystems. Additionally, however, and of special interest, the use of the linear aerospike engine is a departure from the gimbaled engines traditionally used for thrust vector control (TVC) in launch vehicles and poses certain design challenges. This paper discusses the unique problem of designing the X-33 attitude control system with the linear aerospike engine, requirements development, modeling and analyses that verify the design.
Author
X-33 Reusable Launch Vehicle; Aerospike Engines; Laboratory Equipment; Flight Control; Engine Design; Control Systems Design

19990105691 CSA Engineering, Inc., Palo Alto, CA USA
An Experimental Investigation of Tangential Blowing to Reduce Buffet Response of the Vertical Tails of an F-15 Wind Tunnel Model, Volume 1, Tests Results, Discussion and Correlation *Final Report, 1 Jun. 1996 - 31 Dec. 1998*
Ferman, Mrty A.; Turner, Elijah W.; Jan. 1999; 241p; In English
Contract(s)/Grant(s): F33615-94-C-3200; AF Proj. 2404
Report No.(s): AD-A367319; AFRL-VA-WP-TR-1999-3018; No Copyright; Avail: CASI; A03, Microfiche; A11, Hardcopy
    Tangential blowing was investigated as a means to reduce buffeting pressures and response on the tails of a 4.7% scale model of the F-15 Fighter Aircraft in the Subsonic Aerodynamic Research Laboratory (SARL) wind tunnel. Buffeting pressures, structural strains, and structural acceleration were measured and recorded for a range of angles of attack and angles of side slip, and for blowing at three locations on the model, both individually, in combinations, and without blowing. The test were conducted

for two wind tunnel dynamic pressures. One vertical tail was rigid to permit buffet excitation pressures to be measured, and the other was flexible to permit buffet response pressures and structural response to be measured. Unsteady pressure data, strains and accelerations were reduced to PSD and RMS forms. This report contains a general description of the model, the test program, samples of the reduced data, an in depth analysis of the data, and conclusions with respect to the effectiveness of blowing to reduce buffeting of vertical tails.
DTIC
Tangential Blowing; Buffeting; Tail Assemblies; Wind Tunnel Tests; Vertical Orientation; Wind Tunnel Models

19990105718 California Univ., Coll. of Engineering, Santa Barbara, CA USA
Robust Nonlinear Control of Tailless Aircraft *Final Report, 1 Dec. 1997 - 30 Nov. 1998*
Teel, Andrew R.; Feb. 1999; 19p; In English
Contract(s)/Grant(s): F49620-98-1-0087
Report No.(s): AD-A367415; AFRL-SR-BL-TR-99-0204; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The objective of this research was to develop tools leading to effective control strategies for tailless fighter aircraft. Emphasis was placed on the development of control algorithms that yield robust performance in the presence of actuator magnitude and rate limits and that account for the interaction of a pilot with the airframe and control system. The results of this research are documented in the 22 papers that are listed in this report. These papers present the development of numerous new analysis tools for nonlinear control systems with an emphasis on disturbance attenuation and sampled data control. These algorithms were applied to the manual flight control problem for open loop unstable fighter aircraft.
DTIC
Manual Control; Tailless Aircraft; Aerodynamic Stability; Flight Control

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands. For related information see also 14 Ground Support Systems and Facilities (Space).

19990099362 Institut de Recherche des Transports, Arcueil, France
Smart Hubs: Integration Places
Bollo, Daniel, Institut de Recherche des Transports, France; Frybourg, Michel, Ecole Nouvelle d'Organisation Economique et Sociale, France; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 20p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche
The European Union focuses on horizontal integration, including the concepts of interconnection, interoperability and intermodality around which the common policy of transport is articulated. The clue put forward by the authors is the concept of vertical integration, on the basis of the banal remark that freight transport and the logistics sector are services activities and not an end in itself. In the current economy a competitive advantage provided by services often is linked with an value added service. The value added service is added to the basic service provision and precisely makes the difference and thus the benefit. We will present an analysis derived from the OSI model that splits concurrent activities in layers. Finally we assess the role of nodes in integrated transport services.
Author
Cargo; Logistics; Policies; Civil Aviation

19990099368 Regional Inst. for Economic Planning of Tuscany, Florence, Italy
City Airports and Sustainable Urban Development: The Case Study of Florence
Lorenzini, Stefania, Regional Inst. for Economic Planning of Tuscany, Italy; Maltinti, Giovanni, Regional Inst. for Economic Planning of Tuscany, Italy; Benvenuti, Stefano Casini, Regional Inst. for Economic Planning of Tuscany, Italy; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 22p; In English
Report No.(s): Paper-667; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche
The role of infrastructure in the regional development process has been studied for a long time without specifying the direction of the causal relationship. This seems to be particularly true as far as the airports are concerned, which are often considered as strategical determinants of regional growth but also as a factor induced-in other contexts- by the development process itself. In the first stages of development, it can be supposed a weak demand as far as air transport is concerned, in this scenario the decision of building a new airport -for instance in the capitol city of a country- might be considered as a supply-induced policy measure.

In the following phases of growth, the demand for an adequate endowment of transport infrastructures becomes the prevailing factor in the decisions of carrying out investments in this field. In this framework-. city-airports may be seen as "second generation" products if compared with the traditional airports; they meet, in fact, a more restricted and qualified part of mobility demand and are components of a more general "city marketing policy" induced by the need of the cities to be active in urban competition. The city airport of Florence -which showed in few years an important growth of traffic-constitutes the field of empirical analysis of the paper. After a short presentation of the present phase of Florence area development, as well as of the city-airports'case, the present and the future of Florence airport is described; in this part specific emphasis has been devoted to the 2010 demand's forecast by means of a gravity modal-split and econometric model. The second part of the paper analyses the effects of air traffic from the point of view of their typological nature (temporary, permanent, short and long term) taking into account, with a theoretical approach, the unavoidable trade-off between economic benefits and environmental effects.
Derived from text
Airports; Air Traffic; Competition; Economics; Environment Effects

What Airport for the Future? Value Added, Durability and Cooperation
Drewe, Paul, Technische Hogeschool, Netherlands; Janssen, Ben, NEA Transport Research and Training, Netherlands; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 22p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The stage for discussing both the future of air transport and airports is usually set by a simplistic model of extrapolated growth of volumes (number of passengers as well as tons of freight). According to IATA passenger transport, for example, is expected to grow till 2015 world-wide at an average annual growth rate of approximately 5%. Individual airports may grow faster or slower. A simple extrapolation of their present growth would imply a fallacy of disaggregation as it does not take into account the competitive positioning of airports. If air transport is measured in terms of number of flights (transporting either passengers or freight) between origins and destinations, a simplistic approach to airport performance - counting only the number of passengers or tons of freight per airport - causes "double counting". Or even "quadruple counting" in the case of transit. The latter can be an important phenomenon as in the case of Schiphol with the transit shares of almost 50% and 60 to 70% in respectively passenger transport and freight transport. An origin destination matrix of passenger and freight flights including transit and containing information on respectively passenger- and ton-kilometers, provides a more accurate picture of air transport. It is important to gain insight into complete chains extending, ideally, to transport to and from airports. The problem is similar to the modeling of European freight transport. Especially congestion, say within the European Union, requires insight into interconnections at a higher level of aggregation than that of individual airports. Extrapolated growth of volumes is just one side of simplicity, the other side being the assumption of simple relationships between on the one hand, growth and the benefits and costs of air transport, on the other. Economic-benefit and social-cost arguments are more important in discussing the airport for the future than arguments related to either social benefits or economic costs.
Derived from text
Durability; Cooperation; Airports; Extrapolation; Costs; Air Transportation

Estimating the Bias Resulting From the Use of Conventional Mode Choice Models
Abdelwahab, Walid, Al-Isra Univ., Jordan; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 14p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

With the advent of new major policy issues concerning intercity freight and passenger transportation, such as intermodal competition, deregulation, introduction of new modes and/or technologies, researchers have been increasingly dissatisfied with the application and performance of conventional mode choice models. Perhaps the most critical drawback in the application or these modes in the area of intercity freight transportation has been the inability of modeling decisions in a simultaneous rather than sequential matter. It is widely accepted that decision-makers, for example shippers, make their choices of mode, shipment size, frequency, and supply market simultaneously, not in sequence. Therefore, models that deal with only one of these choices, for example, the choice of mode, re-present only one part of the complete model. These models are suspected to produce inaccurate or 'biased" results. Consequently, a number of researchers have developed alternative models to overcome this weakness. This paper provides quantitative evidence on the amount and significance of this 'bias,' by comparing a biased and a biased-free version of the same mode choice model calibrated from the same data set. The biased model is represented by a conventional probit mode choice model, whereas the bias-free model is represented by a simultaneous discrete/continuous model for the joint choice of mode and shipment size. The paper will mainly focus on the effects of simultaneity on the values and significance of the parameter esti-

mates of conventional mode choice models, and on the magnitude of the own and cross elasticities of mode choice probabilities with respect to freight charges. The latter effects should provide all insight into the amount of bias in the degree of intermodal competition estimated in studies employing conventional mode choice models.
Author
Competition; Estimates; Estimating; Mathematical Models; Passengers; Transportation

19990099399 HNTB Architects Engineering Planners, Fort Worth, TX USA
Austin Bergstrom Airport Traffic Control Tower Establishment of a Major Activity Level Tower
Pillar, Roxanne L., HNTB Architects Engineering Planners, USA; Eisenrich, Brian L., Southwest Carlson Associates, USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 15p; In English; See also 19990099396
Report No.(s): Paper-991-Rev; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche
      Robert Mueller Airport has served the City of Austin, Texas, USA, since the 1930's. The surrounding area is completely developed, leaving the City unable to purchase land needed to expand runway capacity for long-term aviation demand. Voter referendums November 3, 1987 and May 1, 1993 confirmed the decision to develop a new commercial airport. Numerous studies identified the active Bergstrom Air Force Base as the preferred site. Options of joint military-civilian use of the Air Force Base were explored but no agreement could be reached. In July 1991, a USA Congressional commission formally recommended that the base be closed. On August 1, 1991, the Austin City Council passed a resolution formally designating Bergstrom as the preferred site for a new commercial airport. Located 7 miles southeast of the Austin central business district but within the city limits, the site is surrounded by predominantly undeveloped land. This paper covers the process utilized to convert a military facility to a commercial airport. The control tower project had to be submitted on fiscal year planning budgets and assigned a Congressional budget line item number. The budget line item number is used for the annual budget submital to the USA (U.S.) Congress. Projects are prioritized and funded as monies are available. A project might go through the annual budget process as many as five times before being discarded or funded. Documentation of the problems and justification for the proposed action had to be submitted to Washington, D.C. and prioritized with other projects from across the USA of America. The City of Austin, Texas, made a commitment to provide portions of the funding to balance the federal government investment. After the project successfully maneuvered this process, project authorization was given by Congress and monies assigned to the project. The Federal Aviation Administration's (FAA) Southwest Regional Office staff was given the assignment to proceed. The FAA Airport Development Office, Airports Division provided grant funding to the City of Austin for portions of the sponsor improvements. The Airway Facilities Division managed the airport facility projects built by the FAA, including the Airport Traffic Control Tower. Austin Bergstrom International Airport is the only new major activity airport under construction in the USA at this time.
Author
Air Traffic Control; Airport Towers; Budgeting; Construction

19990099400 Civil Aviation Authority, Netherlands
A Study to Optimize the Environmental Capacity of Amsterdam Airport Schiphol
deWit, Jaap, Civil Aviation Authority, Netherlands; Veldhuis, Jan, Civil Aviation Authority, Netherlands; Uittenboogaart, Peter, Civil Aviation Authority, Netherlands; Wei–Yun, Thalicia, Civil Aviation Authority, Netherlands; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 9p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche
      The last five years Amsterdam Airport has experienced an extremely high growth. However this growth can be attributed only partly to the growth of the airline market itself. The economic growth of the Netherlands and the Western European region has been moderate in the period 1992-1995. Only 1996 and 1997 have shown some economic recovery, at least in the Netherlands. A factor that certainly has contributed to airline market growth concerns the air fares, which have dropped considerably, especially through the introduction of new promotional fares. But even taking the fares into consideration, the contribution of market growth to Schiphol's growth is moderate. The main factor has been the market share of KLM and its partners. A number of factors can be mentioned in this context. During the first half of the 90's KLM has extended the co-operation with Northwest Airlines, mainly by code sharing on the North Atlantic route, and by offering through connections in the USA by the Northwest-network, and in Europe by the KLM-network. An important year was 1992, when the Netherlands - as the first European state - signed an Open Skies Agreement with the USA. In this agreement an anti-trust immunity for KLM/Northwest was included which made it possible to closely integrate both airline networks. This stimulated traffic at Schiphol further. Also during that period KLM started to build up a new wave system at Schiphol, by concentrating European arrivals and departures (in addition to the European and interconti-

nental) in such a way that connectivity via Schiphol improved considerably, which mainly boosted the connecting traffic via Schiphol.
Derived from text
Research; Optimization; Environmental Quality; Airports; Netherlands; Airline Operations

19990099401 New South Wales Univ., School of Civil and Environmental Engineering, Sydney, Australia
Airport Performance in Stakeholder Involvement and Communication Strategies: A Comparison of Major Australian and North American Air Carrier and General Aviation Airports
Black, John, New South Wales Univ., Australia; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 20p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Communication strategies to engage key stakeholders and communities is a neglected aspect on airport management performance. Benchmarking studies have been conducted at selected airports in Australia and the U.S.A. where facilities are being expanded to accommodate traffic growth. Major issues are aircraft noise, air quality and ground access. The paper reports on environmental management studies, in general, and corporate communications strategies, in particular. Examples of best practice are drawn from U.S. airports. Although environmental management and community participation are established for the Federal Airports Corporation, the recent privatisation of its 22 airports (except for those in the Sydney basin) means that new challenges are faced by airport managers. Interviews conducted as part of the benchmarking study and research into public relations leads to recommendations for corporate change that include more symmetrical communications strategies.
Author
Airports; Environment Management; Organizations; Air Quality; Aircraft Noise

19990099402 Tel-Aviv Univ., Ramat-Aviv, Dept. of Geography, Tel-Aviv, Israel
Airport Planning and Location
Goodovitch, Tomer, Tel-Aviv Univ., Ramat-Aviv, Israel; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 20p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Geographers have long been attempting to discover the spatial regularities of economic development. A critical factor in this process has been the improvement of spatial interaction through the development of transportation systems. From its beginning metropolitan transportation development has been a continuous process of spatial diffusion but also a sporadic process influenced by many specific forces: economic, social and political. Whereas the historical development of maritime and land transport has been well documented in numerous studies, the evolution of air transport has more often been treated separately or on the basis of interregional relationships. From a historical perspective most large metropolitan concentrations owe their existence to water and rail transportation. Air transport has now replaced maritime transport and railways as the basis for trade, technological transfer and economic growth. For example, a city would likely be built next to a natural harbor. As the city spread out in all directions from this original center, the core would become the central business district (CBD). As activities in the CBD and in the harbor increased, their competing claims for land would inevitably conflict. Large ships and faster turnaround capabilities have greatly reduced the number of ships and the length of berth required to handle a given tonnage, but they have also increased the need for a large area behind the berth for handling the tonnage by rail and road. Thus, relocation of the port to new land becomes unavoidable. Each new type of long-distance transportation has repeated this pattern.
Derived from text
Airport Planning; Position (Location); Relocation; Economics; Commerce; Air Transportation

19990099403 Hiroshima Univ., Graduate School for International Development and Cooperation, Japan
Location of International Airport and Regional Development: Socio-Economical Analyses of the Preferences of Travelers, Air Transport Industries and Regions
Tsujimoto, Katsuhisa, Hiroshima Univ., Japan; Toda, Tsunekazu, Hiroshima Univ., Japan; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 56p; In English; See also 19990099396
Report No.(s): Paper-1043; Copyright Waived; Avail: CASI; A04, Hardcopy; A03, Microfiche

The aviation network is largely transforming. In order to cope with the change of the aviation network, what kind of aviation policy is required for each region? Briefly, the aviation network is transforming as follows: First, the role of the airport for the development of cities and regions is rapidly growing. Now, airport can be regarded as "Regional Minimum" facilities, that is to say, one of essential infrastructures for the regional development. Airports are the gateway for travelers, the terminal for the high

value added freights, and the interchange of information. So, after a series of political and economical change, which include the end or the ease of the Cold War, economic growth especially in East Asia, globalization of economic activities, the role of airports has been enlarged as "Regional Minimum" facilities. Second, the composition of international aviation network has changed significantly. Three factors, which are rapid increase of demand for air transportation especially in Asia, recent improvement of aircraft' performance and the liberalization, are proceeding simultaneously. Consequently, the international aviation network will become "Best Mixed Network (BMN)". BMN is the network in which the Hub-and-Spoke Network (HAS) and the Direct Flight Network (DFN) are mixed best. Third, the international aviation fare system is changing greatly. Today, most of local airports in Japan do not have an international direct fare. However, the opportunities for international travelers to arrive or depart to/from local airports will increase the spread of the international direct fare, because of the intensification of competition. In order to cope with the change of the aviation network, what kind of aviation policy is required for each region? In other words, how to improve international airport in each region? How managed it? In addition, how to use it to activate regional economy and society? Objective criteria and indices are required for this complicated issues.

Derived from text

Position (Location); Airports; Air Transportation; Economics; Industries; Politics

19990099404 Instituto Tecnologico de Aeronautica, Sao Paulo, Brazil

A Simulation Technique for Analysis of Brazilian Airport Passenger Terminal Buildings

Alves, Claudio Jorge Pinto, Instituto Tecnologico de Aeronautica, Brazil; deAlmeida, Paulo Marcos Santo, Instituto Tecnologico de Aeronautica, Brazil; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 6p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Air Transport industry continues to show signs of improving health. From 31,000 thousands passengers carried in the world civil air transport in 1950 to 1,258 million passengers in 1995. International Air Transport Association (IATA) expects total international scheduled passengers traffic to grow at 6.6% for the five-year period ending in 1998. Boeing's forecast for the cargo industry predicts a 6.6% annual growth rate. Airbus predicts an annual growth rate of 5.1% in worldwide revenue passenger kilometers. The trends are to keep the growth rates positively. In Brazil, to the next four-year period, investments are estimated in more than US$ 2,500 million in the air transport industry. The movement in the busiest Brazilian airport, the International Sao Paulo/ Guarulhos, went beyond 12 million passengers in 1997. Airport systems are normally near its saturation point: Belem, Fortaleza, Natal, Porto Alegre and Rio Branco Airport Terminal Buildings are under construction. The costs to extend or to refurbish some installation are too high! There are financial restrictions and environmental oppositions to enlarge those infrastructures. There are, more and more, a single choice to increase productivity: make more with less. The usual procedures for designing and operating airport passenger terminal buildings normally create to either high operating and maintenance costs or passenger conflicts. Many researches have been conducted intending a reduction of "door-to-door" travel time, which contains an increasing proportion of ground time as compared with actual flight time. As the aviation industry evolved, it became increasingly competitive and far more volatile. For the airport planner, this has meant designing terminals that could reach obsolescence before leaving the drawing board. In order to be able to compare a number of design alternatives and examine the "what if?" scenarios that are vital in today's environment the utilization of simulation models is suggested. This paper develops a simulation technique that helps the designer "to see in operation" his solutions for existing problems or to analyze layout options as a function of previewed scenarios, thus futures conflicts can be predicted and avoided.

Derived from text

Simulation; Procedures; Air Transportation; Aircraft Industry; Commercial Aircraft; Maintenance; Operating Costs

19990099405 Kansai Gaidai Univ., Hirakata, Japan

Multimodal Airport Access in Japan

Kato, Kazusei, Kansai Gaidai Univ., Japan; Sakakibara, Yasuo, Osaka Univ., Japan; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 15p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this paper, the authors intend to analyze factors that affect access modal choice in Japan. Most airports, excepting very small ones, in Japan have multimodal access: by bus and private automobile. A few large airports-Kansai, Narita, Haneda, Silin-Chitose, Fukuoka and Osaka - have rail access also. We weighted quantitatively relative significance of money cost, travel time and other factors that were assumed to determine the modal choice. Because of limitations of available data and because of differences among individual airports, our cross-sectional approaches to the access share had somewhat lower fits than we had hoped for. Nevertheless our findings seem to have a few policy implications. For example our research revealed that parking charges at air-

ports were a crucial factor in access modal choice in Japan and so, if one wants to increase the patronage of mass transport, increase in parking charges for private automobile seems most effective. We want to comment on other factors also.
Author
Airports; Classifications; Construction; Environment Protection; Policies; Subdivisions

19990099406 Ministerie van de Vlaamse Gemeenschap, Brussels, Belgium
Planning Surface Access Provision at Major Airports
DeRyck, Luc, Ministerie van de Vlaamse Gemeenschap, Belgium; Jones, Roger, West Sussex County Council, UK; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 9p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Air travel in Europe is growing at a faster rate than any other means of transport, typically 6% per annum despite economic recessions in several countries. The recent deregulation of air transport in Europe could well accelerate this process. However, surface transport systems which serve the airports, particularly roads, are not keeping up with this increased demand for capacity. This is not just a question of the money not being available for investment in new roads. Many governments, national and local, are questioning the sustainability of unconstrained road building and in some cases are already acting upon this by cutting their construction programmes. It is within this context that the Airport Regions Conference, a Pan-European network of regional councils, was founded in November 1995. All the regional councils have the common feature of a major international airport within their boundaries, often serving a city outside of the regional boundary. The network has set up four working groups to address issues arising from the day to day operations of major airports and the forward planning of airport expansion. One of these groups is dealing with surface access to the airport and this presentation is submitted on behalf of this group with its agreement.
Author
Airports; Planning; Construction; Economics; Roads; Air Transportation

19990099408 Nebraska Univ., Dept. of Public Administration, Omaha, NE USA
Airport Financing and User Charge Systems in the USA
Bartle, John R., Nebraska Univ., USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 14p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper examines the financing of U.S. public airports in a turbulent era of change, and projects toward the future. It begins by briefly outlining historical patterns that have changed the industry, and airport facilities in particular. It then develops basic principles of public finance as applied to public infrastructure, followed by the applicable principles of management. Following that, the current airport financing system is analyzed and contrasted with a socially optimal financing system. A concluding section suggests policy reforms and their likely benefits. The principles of finance and management discussed here are elementary. However, their implications are radical for U.S. airport policy. There is a great deal of room to improve the allocation of aviation infrastructure resources. The application of these basic principles makes it evident that in many cases, current practice is wasteful, environmentally unsound, overly costly, and inequitable. Future investments in public aviation capital will continue to be wasteful until more efficient pricing systems are instituted. Thus, problem in the U.S. is not one of insufficient investment in airport infrastructure, but investment in the wrong types of infrastructure. In the U.S., the vast majority of publically-owned airports are owned by local governments. Thus, while the federal government bad a great deal of influence in financing airports, ultimately these are local decisions. The same is true with many other public infrastructure issues. Katz and Herman (1997) report that in 1995, U.S. net public capital stock equaled almost $4.6 trillion, 72% of which ($3.9 trillion) was owned by state and local governments, most of it in buildings, highways, Streets, sewer systems, and water supply facilities. Thus, public infrastructure finance is fundamentally a local government issue, with implications for federal and state governments in the design of their aid programs.
Author
Airports; Finance; Highways; Policies

19990099411 Lemaitre (Anne), Papeete, French Polynesia
The Development of Performance Indicators for Airports: A Management Perspective
Lemaitre, Anne, Lemaitre (Anne), French Polynesia; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 16p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The literature in general management has argued that financial performance indicators need to be complemented by non financial performance indicators. Thus in accounting it has been argued that researchers should attempt to develop non-financial measures of manufacturing performance, such as productivity, quality, and inventory costs. Later following this theme, Kaplan

and Norton (1992) developed the balanced score card which included not only financial measures but also indicators from the customer, internal business process and innovation perspective. This paper will examine the measurement of airport performance from three general management perspectives: the financial perspective, the marketing perspective and the operational perspective.
Author

Airports; Marketing; Productivity; Financial Management

19990099413 HNTB Architects Engineering Planners, Fort Worth, TX USA

Austin Bergstrom West Loop Cable System

Pillar, Roxanne L., HNTB Architects Engineering Planners, USA; Eisenrich, Brian L., Southwest Carlson Associates, USA; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 10p; In English; See also 19990099396

Report No.(s): Paper-990-Rev; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Robert Mueller Airport has served the City of Austin, Texas, USA since the 1930's. Unable to purchase land needed to expand runway capacity for long-term aviation demand at the present Muller Airport, the issue was put to public vote. Voter referendum November 3, 1987, and May 1, 1993, confirmed the decision to develop a new commercial airport. Numerous studies identified the active Bergstrom Air Force Base as the preferred site. Options of joint military-civilian use of the Air Force base were explored. In July 1991, a United State Congressional commission formally recommended that the base be closed. On August 1, 1991, the Austin City Council passed a resolution formally designating Bergstrom as the preferred site for a new commercial airport. The site is located 7 miles southeast of the Austin central business district but within the city limits. At the Federal Aviation Administration (FAA), this project had to be submitted on fiscal year planning budgets and assigned a Congressional budget line item number. The budget line item number is used for the annual budget submittal to the USA (U.S.) Congress. Projects are prioritized and funded as monies are available. A project might go through the annual budget process as many as five times before being discarded or funded. Documentation of the problems and justification for the proposed action had to be submitted to Washington, D.C. and prioritized with other projects from across the USA of America. The City of Austin, Texas, made a commitment to provide portions of the funding to balance the federal government investment. After the project successfully maneuvered this process, project authorization was given by Congress and monies assigned to the project. The FAA Southwest Regional Office staff was given project authorization and the assignment to proceed with the design. The Airway Facilities Division manages the airport facility projects built by the FAA including the loop cable system. The conversion of an existing military air force base to a joint use or non-military airport poses special considerations. Issues and concerns become twofold with a planned additional parallel runway. Existing navigational aids (navaids) such as instrument landing systems, approach light systems, radar facilities, and remote radio sites must be replaced and/or upgraded and new navaids planned, designed and installed. Ultimately all components of the air traffic capabilities of the airport must be controlled and monitored at the airport traffic control tower (ATCT). The navaids are controlled and monitored at the ATCT through a loop cable control system. The configuration and routing of a duct bank system to support the loop cable system is based on mandatory and non-mandatory FAA criteria, in-house review of the recommendations and coordination with the sponsor (airport owner). Austin Bergstrom International Airport is the only new major activity airport under construction in the USA at this time. In addition to converting a former military base to a commercial airport, this project includes coordination of loop cable system and joint use of the system by the FAA and the City of Austin. This joint use has operations and financial implications beyond the usual relationship of FAA to sponsor.
Derived from text

Air Traffic; Airport Towers; Airports; Budgeting; Construction; Instrument Landing Systems; Navigation Aids

19990099414 Tarbiat Modares Univ., Dept. of Civil Engineering, Tehran, Iran (Islamic Republic of)

An Optimum Resource Allocation Model for Airport Passenger Terminals

Parizi, Mahmoud Saffarzadeh, Tarbiat Modares Univ., Iran (Islamic Republic of); The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 2; 10p; In English; See also 19990099396; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

There has been little research to involve optimization theory in the planning, design, and operation of airport PTBs. The only exception is development of a design methodology, based on the heuristic modelling technique, to produce an optimum terminal design (1). The methodology is composed of three major algorithms; facility sizing algorithm, the load assignment algorithm, and the facility layout algorithm. This methodology determines the minimum amount of areal spaces first, and second the loads are assigned to the facilities in such a way that transport cost, expressed as the sum of the products of passenger flow times distance, is at minimum. Then the facilities are located relative to each other in such a manner that the transport cost is also at a minimum. The second and third steps are iterated until an optimum design has been obtained. The methodology is very useful in planning and design in terms of optimum concept selection. It does not deal with the PTB components in detail in terms of operating charac-

teristics and stochastic demand. In this research, the whole PTB is considered as a system in which labor, capital, and services are deployed to produce certain services to passengers. The function of this complex system may be seen as taking a passenger and providing some services to that passenger. This provision of services is associated with some cost to operators as well as passengers. For example, operating and maintenance costs which constitute a major portion of the total cost, has been almost always neglected in the current planning and design procedures. Operating and maintenance costs can be reduced by a reduction in level of service, especially at peak periods, but at some cost to the passenger. The least cost solution may not be always the best solution for the passenger. On the other hand, terminal configurations that supposedly offer high levels of service may be expensive to operate. Those costs will be ultimately paid by the traveller either through higher fares, or other user charges. Optimizing the associated costs with the PTB operation is the subject of the optimization model discussed in this paper.
Author
Research; Terminal Facilities; Airports; Optimization; Models; Design Analysis; Passengers; Layouts

19990103064 National Aerospace Lab., Tokyo Japan
Parallel Computations of Incompressible Viscous Flow in a Lid-Driven Square Cavity and Program Performance on the NWT Computer System
Hatayama, S.; Oct. 1998; 48p; In English
Report No.(s): PB99-169633; NAL-TR-1363T; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
This paper reports parallel computations of incompressible viscous flow in a lid-driven square cavity on the NWT computer system. In order to obtain numerical solutions of this flow, consistent finite-difference approximations on non-staggered grids and four iterative solution methods are used. Computations are performed on the Reynolds number range of Re = 0 to approximately 100,000, and effect of the Reynolds number, number of processing element (pe) in parallel processing, solution method and grid size on the computational results are examined. Actual rates of the parallelized square cavity programs on the NWT computer system are measured, and two characteristic parameters of these programs are estimated for the cases that the actual rate is considered as a function of pe and that the actual rate is considered as a function of the grid size. Measurements of the maximum actual rate and estimations of the speedup and efficiency against pe on the NWT computer system are indicated as well.
NTIS
Parallel Processing (Computers); Incompressible Flow; Cavities; Viscous Flow; Computer Systems Performance

19990104344 Institute for Human Factors TNO, Soesterberg, Netherlands
The Development of Training Simulator Specifications *Interim Report De Ontwikkeling van Specificaties voor Trainingssimulatoren*
Verstegen, D. M. L., Institute for Human Factors TNO, Netherlands; Barnard, Y. F., Institute for Human Factors TNO, Netherlands; vanRooij, J. C. G. M., Institute for Human Factors TNO, Netherlands; Jun. 17, 1999; 40p; In Dutch
Contract(s)/Grant(s): B98-051; TNO Proj. 730.1
Report No.(s): TD99-0321; TM-99-B006; Copyright; Avail: Issuing Activity, Hardcopy
Specifications for training simulators should be derived from training needs: which features and functions of the real system should be simulated depends on the tasks to be trained. Additional facilities are required for instructional purposes. Issues that should be addressed include: simulator coverage, integration in overall training, adaptation to target groups of trainees and to the needs of individual trainees, instruction, guidance and feedback, assessment of trainees, quality assurance and evaluation of training, adaptation of training and/or scenarios, instructor support and lay down specifications and specification process. Apart from ensuring that these issues are addressed, a methodology for the development of training simulator specifications should provide structure and guidance, support information, resource and process management and provide opportunities for quality control and the storage and reuse of information. A methodology for the development of functional specifications for training simulators has been developed in the context of a European defence research project (MASTER project, EUCLID RTP 1 1.1). The MASTER methodology seems to meet most of the requirements: it offers a clear structure of steps and decisions to be taken and it provides a framework to store and organize knowledge available from experts and research literature and make it concrete and applicable during the development of training simulator specifications. The iterative aspect of the development process is, however, not sufficiently supported. Further research will be directed towards the development, implementation and validation of support facilities to help users to take process-oriented decisions and to organize their own iterative development process.
Author
Training Simulators; Product Development; Resources Management; Functional Design Specifications

19990104354 Air Force Research Lab., Materials and Manufacturing Directorate, Wright-Patterson AFB, OH USA

Testing of Aircraft Runway Ice Control Products. Materials Compatibility *Final Report, Oct. 1997 - Oct. 1998*

Gulley, Lee; Oct. 1998; 195p; In English

Contract(s)/Grant(s): Proj-4349

Report No.(s): AD-A364904; AFRL-ML-WP-TR-1999-4040; AFRL/MLSA-98-137; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

New commercial formulations of runway ice control products have recently made their way onto military and commercial aircraft runways. These new ice control products are purchased to AMS/SAE (Aerospace Materials Specifications/ Society of Automotive Engineers) 1431 and 1435. These products have not been tested for compatibility with a number of aircraft materials, many of which are common to both commercial and military aircraft. In addition, there are some materials that are unique to military aircraft; infrared windows for example for which no compatibility testing had been done, to fill this knowledge gap, AFRL/ MLSA undertook a study to evaluate the compatibility of these products with aerospace materials. The compatibility testing performed on these products exceeds the AMS/SAE specification requirements. This report documents AFRL/MLSA'S effort to identify possible problems for both commercial and military aircraft with new deicer/anti-icer materials not evident with the previously used ice control materials.

DTIC

Runways; Deicers; Specifications; Requirements

19990105728 Institute for Human Factors TNO, Soesterberg, Netherlands

Flight Simulation: Visual-vestibular Stimulation *Interim Report Vliegtuigsimulatie: Visueel-vestibulaire Stimulatie*

Hosman, R. J. A. W., Institute for Human Factors TNO, Netherlands; Bles, W., Institute for Human Factors TNO, Netherlands; May 11, 1999; 32p; In Dutch

Contract(s)/Grant(s): A98/KLu/310; TNO Proj. 789.3

Report No.(s): TD99-0040; TM-99-A034; Copyright; Avail: Issuing Activity, Hardcopy

Simulation in general and aircraft simulation in particular will obtain a wider application in the future. Fighter simulation, however, lags behind this development. This is primarily a result of the limited capacity of the presently used training simulators with Stewart motion platforms which do not provide the fighter pilot with the required visual-vestibular stimulation during high-G manoeuvres characteristic of the fighter operation. In this report, a survey of the technical facilities, visual display systems and motion systems, available for flight simulation is presented. In addition, the requirements for the visual-vestibular stimulation of the fighter pilot during training simulation are discussed. Based on this overview, it turns out that the lack of G loading during simulation of manoeuvres is the limiting factor in the present fighter simulation. This limits the military simulation to procedure training in fixed-base simulators. On account of these considerations, a new concept for a motion system with six degrees of freedom and the ability to generate a lasting G-loading is introduced. This Desdemona concept is considered a suitable research tool to develop the essential experience and knowledge for the simulation of high-G manoeuvres. The report concludes with some recommendations for supporting research.

Author

Flight Simulation; Vestibules; Training Simulators; Display Devices

12
ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see 91 Lunar and Planetary Exploration.

19990100660 NASA Marshall Space Flight Center, Huntsville, AL USA

The Faster, Better, Cheaper Approach to Space Missions: An Engineering Management Assessment

Hamaker, Joseph W., NASA Marshall Space Flight Center, USA; [1999]; 10p; In English; Space Technology, 28-30 Sep. 1999, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

NASA was chartered as an independent civilian space agency in 1958 following the Soviet Union's dramatic launch of the Sputnik 1 (1957). In his state of the union address in May of 1961, President Kennedy issued to the fledging organization his famous challenge for a manned lunar mission by the end of the decade. The Mercury, Gemini and Apollo programs that followed put the utmost value on high quality, low risk (as low as possible within the context of space flight), quick results, all with little regard for cost. These circumstances essentially melded NASAs culture as an organization capable of great technological achievement but at extremely high cost. The Space Shuttle project, the next major agency endeavor, was put under severe annual budget constraints in the 1970's. NASAs response was to hold to the high quality standards, low risk and annual cost and let schedule

suffer. The result was a significant delay in the introduction of the Shuttle as well as overall total cost growth. by the early 1990's, because NASA's budget was declining, the number of projects was also declining. Holding the same cost and schedule productivity levels as before was essentially causing NASA to price itself out of business. In 1992, the helm of NASA was turned over to a new Administrator. Dan Goldin's mantra was "faster, better, cheaper" and his enthusiasm and determination to change the NASA culture was not to be ignored. This research paper documents the various implementations of "faster, better, cheaper" that have been attempted, analyzes their impact and compares the cost performance of these new projects to previous NASA benchmarks. Fundamentally, many elements of "faster, better, cheaper" are found to be working well, especially on smaller projects. Some of the initiatives are found to apply only to smaller or experimental projects however, so that extrapolation to "flagship" projects may be problematic.

Author

NASA Programs; Space Programs; Space Missions; Spacecraft Launching; Launch Costs; Low Cost; Cost Reduction; Financial Management; Budgeting

19990100680 Naval Research Lab., Washington, DC USA

Orbit Analysis Tools Software Version 1 for Windows User's Guide

Middour, Jay W.; Hope, Alan S.; Cox, Jenna L.; Llewellyn, Robin K.; Jun. 30, 1999; 87p; In English

Report No.(s): AD-A366086; NRL//MR/8103--99-8388; No Copyright; Avail: CASI; A01, Microfiche; A05, Hardcopy

The Orbit Analysis Tools Software (OATS) is a mission planning and analysis tool for earth-orbiting satellites. OATS evolved from a collection of software tools developed by the Astrodynamics and Space Applications Office of the Naval Center for Space Technology (NCST), located at the Naval Research Laboratory (NRL) in Washington, DC. There have been three previous versions of OATS that are available to the public for use on a Macintosh computer. This release of the OATS program is a revised and expanded version for use on the Windows 95 and Windows NT operating systems. The program's function is to perform satellite mission and coverage analysis using numerical and graphical techniques to analyze and display earth coverage data and ground-to-satellite geometrical parameters. Satellite ephemerides can be computed by any of the four orbit propagators provided with the program, or they can be imported from an external source. Six commonly utilized map projections are available to plot computational results. Some of the program enhancements for Version 1 include the typical Windows point-and-click interface through the use of menu options and toolbar buttons. This latest release also provides a real time propagation option for generating the ephemeris data. This feature simultaneously generates the ephemeris and graphically displays the current satellite position and tracks on a map in real time. A series of validation tests of Version 1 OATS for Windows were conducted for functionality and accuracy. The verification method was accomplished by making comparisons between computations and displays of Version 1 OATS for Windows and the previously validated Version 5.0.4 OATS for the Macintosh. The new Windows interface was written using Visual C++, and the OATS program runs on Windows 95, 98, or Windows NT operating systems which requires 8 MB RAM, 5 MB hard disk space.

DTIC

Applications Programs (Computers); User Manuals (Computer Programs); Mission Planning; Artificial Satellites; Earth Orbits; Real Time Operation; Astrodynamics

19990102905 NASA Marshall Space Flight Center, Huntsville, AL USA

Reaching for the Stars

Barrett, Chris, NASA Marshall Space Flight Center, USA; 1999; In English, 22-26 Jun. 1999, Phoenix, AZ, USA; Sponsored by Society of Women Engineers; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The NASA Administrator, Dan Goldin, has given us the challenge to literally "Reach for the Stars" by requesting an Interstellar Mission. The star that has been chosen for the design reference mission is Alpha Centauri, located at a distance of 4.3 light years from Earth. As an additional enticement for this mission, the discovery of four newly formed solar systems was announced in May of 1998. In July of 1998, a NASA/AIAA Interstellar Mission Workshop was held at the California Institute of Technology in Pasadena, California to develop the Interstellar Mission roadmap including a set of precursor missions, and to examine advanced propulsion concepts to enable these missions. This paper outlines the Interstellar Mission, related Precursor Interstellar Missions, and the advanced propulsion research and technology development activities being conducted to support these missions.

Author

Interstellar Spacecraft; Interplanetary Flight; Interstellar Travel; Space Exploration; Interplanetary Spacecraft; Mission Planning; Centaurus Constellation

19990103145 NASA Marshall Space Flight Center, Huntsville, AL USA

Recent Results of NASA's Space Environments and Effects Program

Minor, Jody L., NASA Marshall Space Flight Center, USA; Brewer, Dana S., NASA, USA; [1998]; 1p; In English; 49th; International Astronautical Congress, 28 Sep. - 2 Oct. 1998, Melbourne, Australia; Sponsored by International Astronautical Congress

Report No.(s): IAF-98-I.5.06; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

    The Space Environments and Effects (SEE) Program is a multi-center multi-agency program managed by the NASA Marshall Space Flight Center. The program evolved from the Long Duration Exposure Facility (LDEF), analysis of LDEF data, and recognition of the importance of the environments and environmental effects on future space missions. It is a very comprehensive and focused approach to understanding the space environments, to define the best techniques for both flight and ground-based experimentation, to update the models which predict both the environments and the environmental effects on spacecraft, and finally to ensure that this information is properly maintained and inserted into spacecraft design programs. Formal funding of the SEE Program began initially in FY95. A NASA Research Announcement (NRA) solicited research proposals in the following categories: 1) Engineering environment definitions; 2) Environments and effects design guidelines; 3) Environments and effects assessment models and databases; and, 4) Flight/ground simulation/technology assessment data. This solicitation resulted in funding for eighteen technology development activities (TDA's). This paper will present and describe technical results rom the first set of TDA's of the SEE Program. It will also describe the second set of technology development activities which are expected to begin in January 1998. These new technology development activities will enable the SEE Program to start numerous new development activities in support of mission customer needs.
Author

Environment Effects; NASA Programs; Aerospace Environments

19990103356 Air Force Academy, CO USA

GPS Signals in a Geosynchronous Transfer Orbit: "Falcon Gold" Data Processing *Final Report, 1 Mar. 1998 - 1 Mar. 1999*

Powell, Thomas D.; Martzen, Phillip D.; Sedlacek, Steven B.; Chao, Chia–Chun; Silva, Randy; Jan. 03, 1999; 12p; In English

Contract(s)/Grant(s): Proj-

Report No.(s): AD-A367240; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

    The US Air Force Academy sponsored experiment "Falcon Gold" was flown in November 1997 to measure Global Positioning System (GPS) signals at high orbital altitudes using the NAVSYS TIDGET sensor. This sensor collects and digitizes short intervals of RF energy which can be processed to extract any GPS signals present in the data. In cooperation with NAVSYS and US Air Force Academy personnel, analysts at The Aerospace Corporation obtained and processed the Falcon Gold spacecraft data. The methods and results of the data processing are presented here. The analysis has yielded positive confirmation of GPS signal detection at altitudes approaching geosynchronous orbit, and provides valuable information for future geosynchronous GPS users.
DTIC

Gold; Global Positioning System; Geosynchronous Orbits; Signal Detection; Data Processing

19990105635 Jet Propulsion Lab., California Inst. of Tech., Pasadena, CA USA

A New Plan for Sending Humans to Mars: The Mars Society Mission

Second Annual HEDS-UP Forum; 1999, pp. 35-54; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

    Optimal cost and safety will be instrumental not only in sending humans to Mars, but also in achieving the political support and scientific consensus that will allow such an endeavor to begin. The Mars Society Mission (MSM) was created to improve upon the safety, cost, and political viability of previous plans, with emphasis on the NASA Reference Mission 3.0 (RM 3.0). The Mars Society Mission is a complete description of a possible 5-human expedition to the Red Planet targeted at the 2011 (cargo) and 2014 (crew) launch opportunities. All components are capable of performing in any succeeding launch windows. The Mars Society Mission features: 1. Increased redundancy of design for reduced development. For instance, the Mars Society Mission's Mars Ascent Vehicle (MAV) and Earth Return Vehicle (ERV) derive from a common Crew Return Vehicle (CRV, distinct from that planned for the International Space Station). 2. Increased redundancy for maximum safety. A CRV will accompany the outbound habitat module, and in the event of habitat failure would be able to support the crew until arrival on Mars or Earth. After a 612-day surface stay, both the MAV and ERV will accompany the crew during, the return to Earth. If either ERV or MAV fails, or Mars orbital rendezvous does not take place, either component could return the crew. 3 . The Qahira Interplanetary Transportation System (QITS, pronounced "Keats"). QITS is based on the Qahira launch vehicle, a Delta-IV inspired heavy lifter with only two new components, the Qahira Booster Core (QBC) with 4 RS-68 engines, and the Qahira Upper Stage (QUS), with 1 RD0 120 engine.

The maximum configuration, the Q304 1, is capable of sending 55 MT trans-Mars. 4. Detailed and improved trajectories, including a 3/2 Hohmann transfer orbit for the ERV that minimizes propellant boil-off and reduces launch facility strain, as well as optimal trajectories for cargo, free-return, and return from Mars surface. 5. "Piggyback" payload capabilities to reduce launch costs and encourage additional planetary science missions. 6. Minimal assembly in Earth orbit, specifically no more than one Earth orbit rendezvous. 7. No nuclear thermal rocketry, and no activation of nuclear power sources until Mars surface. 8. A large science payload, with 13.7 MT available for the 2014 mission. The 2014 Mars Society Mission will consist of five launches, four of which will use the Q3041 configuration: Payload (A), ERV in June 2011; (B) Cargo includin(y power, hydrogen and science in October 2011; (C) MAV and In-Situ Resource Utilization in November, 2011; and (D) Habitat module in January 2Ol4. A Q1310 configuration will launch Payload (E), Crew in CRV, also in January, 2014. Extensive computer programming and simulation were used to design launch vehicles and trajectories. Comparative risk analysis indicates that the Mars Society Mission has significantly less risk of failure than the Reference Mission 3.0 or Mars Direct.
Author

Computer Programming; Expeditions; Launch Vehicles; Launch Windows; Mars Missions; Mars Surface; Orbital Rendezvous; Safety; Space Missions

13
ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

19990102423 NASA Wallops Flight Center, Wallops Island, VA USA
Tracking the Relative Motion of Four Space Payloads Launched from a Sub-Orbital NASA Rocket
Martell, Hugh, Waypoint Consulting, Inc., Canada; Bull, Barton, NASA Wallops Flight Center, USA; 1999; 1p; In English; GPS, Sep. 1999, Nashville, TN, USA; Sponsored by Institute of Navigation; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

One problem, which is comparatively new in the field of GPS applications, is the determination of the relative trajectories of space vehicles. Applications include the docking of spacecraft, collision avoidance in the area of space stations, and trajectory reconstruction of multiple payloads. The required precision in any of these applications will vary, according to the requirements of the task and abilities of GPS to cope with the environment and the dynamics. This paper describes the post-mission reconstruction of the relative trajectories of four GPS receivers attached to four payloads jettisoned from a Black Brant XII rocket. This vehicle was launched by the National Aeronautics and Space Administration (NASA) in January 1999 from the Poker Flats Research Range near Fairbanks, Alaska. The Black Brant XII is a sub-orbital rocket designed to carry payloads of 100 to 500 kg into the upper atmosphere. Flight time is generally in the order of 10-20 minutes. In this experiment, a GPS receiver and antenna was attached to each of the four payloads. One of the GPS receivers was assigned as the "base station", while the other 3 receivers were designated as remotes. GPS time, code and phase measurements were telemetered to a ground station for real-time processing and storage. The object of the mission was to re-compute the position and velocity of the remote units with respect to the base station during the launch phase and after the payloads separated. During the launch segment the 3 baseling distances between the 4 antennas are known from plans and are constant values until each payload is released. On the fly ambiguity determination was used to establish local coordinates from the base antenna to each of the other 3 GPS units during flight. Distance computations were made from the GPS-derived coordinates and compared to plan distances. Using this methodology an error analysis of the relative GPS accuracies has been presented and in addition a description given of the respective payload behaviour following separation from the vehicle.
Author

Collision Avoidance; Global Positioning System; Telemetry; Trajectories; Orbit Determination; Satellite Constellations; Space Navigation; Satellite Tracking; Stationkeeping

Includes launch complexes, research and production facilities; ground support equipment; e.g., mobile transporters; and simulators. For related information see also 09 Research and Support Facilities (Air).

19990102418 NASA Wallops Flight Facility, Wallops Island, VA USA
Low Earth Orbiter: Terminal
Kremer, Steven E., NASA Wallops Flight Facility, USA; Bundick, Steven N., NASA Wallops Flight Facility, USA; [1999]; 1p; In English; Telemetry, Unknown; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

In response to the current government budgetary environment that requires the National Aeronautics and Space Administration (NASA) to do more with less, NASA/Goddard Space Flight Center's Wallops Flight Facility has developed and implemented a class of ground stations known as a Low Earth Orbiter-Terminal (LEO-T). This development thus provides a low-cost autonomous ground tracking service for NASA's customers. More importantly, this accomplishment provides a commercial source to spacecraft customers around the world to purchase directly from the company awarded the NASA contract to build these systems. A few years ago, NASA was driven to provide more ground station capacity for spacecraft telemetry, tracking, and command (TT&C) services with a decreasing budget. NASA also made a decision to develop many smaller, cheaper satellites rather than a few large spacecraft as done in the past. In addition, university class missions were being driven to provide their own TT&C services due to the increasing load on the NASA ground-tracking network. NASA's solution for this ever increasing load was to use the existing large aperture systems to support those missions requiring that level of performance and to support the remainder of the missions with the autonomous LEO-T systems. The LEO-T antenna system is a smaller, cheaper, and fully autonomous unstaffed system that can operate without the existing NASA support infrastructure. The LEO-T provides a low-cost, reliable space communications service to the expanding number of low-earth orbiting missions around the world. The system is also fostering developments that improve cost-effectiveness of autonomous-class capabilities for NASA and commercial space use. NASA has installed three LEO-T systems. One station is at the University of Puerto Rico, the second system is installed at the Poker Flat Research Range near Fairbanks, Alaska, and the third system is installed at NASA's Wallops Flight Facility in Virginia. This paper will describe the current NASA implementation of the LEO-T network of antenna systems, the customers now being supported, and the services NASA can now offer with this new breed of autonomous ground stations. In addition, the paper will define the technical capabilities of the system and the cost effectiveness of using the systems including the capital costs of installation.
Author
Earth Orbits; Earth Terminals; Low Cost; Low Earth Orbits; Spacecraft Tracking; Telemetry; Tracking Networks; Satellite Communication; Tracking Stations

19990102865 NASA Marshall Space Flight Center, Huntsville, AL USA
An Overview of the MSFC Electrostatic Levitation Facility
Rogers, J. R., NASA Marshall Space Flight Center, USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Savage, L., NASA Marshall Space Flight Center, USA; Soellner, W., NASA Marshall Space Flight Center, USA; Huie, D., NASA Marshall Space Flight Center, USA; Jan. 01, 1999; In English; 128th, 28 Feb. - 5 Mar. 1999, San Diego, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Containerless processing represents an important area of research in microgravity materials science. This method provides access to the metastable state of an undercooled melt. Containerless processing provides a high-purity environment for the study of reactive, high-temperature materials. Reduced gravity affords several benefits for containerless processing, for example greatly reduced positioning forces are required and therefore samples of greater mass can be studied. Additionally in reduced gravity, larger specimens will maintain spherical shape which will facilitate modeling efforts. Space Systems/LORAL developed an Electrostatic Containerless Processing System (ESCAPES) as a materials science research tool for investigations of refractory solids and melts. ESCAPES is designed for the investigation of thermophysical properties, phase equilibria, metastable phase formation, undercooling and nucleation, time-temperature- transformation diagrams and other aspects of materials processing. These capabilities are critical to the research programs of several Principal Investigators supported by the Microgravity Materials Science Program of NASA.
Author
Levitation; Research Facilities; Electrostatics; Microgravity; Procedures; Metastable State; Supercooling; Time Temperature Parameter

19990103157 Lockheed Martin Corp., Skunk Works, Palmdale, CA USA

X-33 Integrated Test facility, Extended Range Simulation

Sharma, Ashley, Lockheed Martin Corp., USA; 1998; 1p; In English; Telemetry, 26-29 Oct. 1998, San Diego, CA, USA

Contract(s)/Grant(s): NCC8-115; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In support of the X-33 Single Stage to Orbit program, NASA Dryden Flight Research Center was selected to provide continuous communications coverage of the X-33 vehicle from launch, through landing at Malmstrom Air Force Base, Montana and Michaels Army Air Field, Utah. An extensive real-time range simulation capability is being developed to ensure successful communications with the autonomous X-33 vehicle. This paper will provide an overview of the various levels of simulation being developed to support the X-33 extended range subsystems. These subsystems include the Flight Termination System, L-Band command uplink subsystem and the S-Band telemetry downlink subsystem. In addition, the radar model developed provides continuous azimuth, elevation and range information based on the flight trajectory. The Dynamic Ground Station Analysis model developed by NASA Goddard Space Flight Center, calculate the received signal strength at each ground station. This model takes into consideration Radio Frequency (RF) link parameters such as frequency, antenna gain, space loss, plasma effects and the vehicle's position and attitude at any point in time during the flight path. All three RF links are then attenuated based on this calculated level and the RF signals are sent into telemetry receivers to emulate remote sites, or the power incident on the vehicle from uplinked signals. The best source received telemetry data is then passed back to the Launch and Mission Control Monitoring System (LMCMS) resident in the Operations Control Center. The LMCMS also provides the range simulation system the uplink command combined with differential GPS corrections. Later stages will require the progressive integration of actual range hardware with this simulation effort, leading to communication between telemetry, uplink and FTS antennas at NASA Dryden Flight Research Center, with vehicle antennas mounted on the Walter C. Williams Research Aircraft Integration Facility (RAIF). Decommutated Pulse Code Modulated (PCM) data is displayed on one of the four monitors that comprise the Range Safety Officer's (RSO) station. Also displayed are instantaneous impact prediction models, and Federal Aviation Administration (FAA) data for notification of other traffic in the area. Aside from initiating the flight termination command and validating communication links, the RSO station with the range simulation will be used to provide both range control and range safety officers training. The training is necessary to perform their respective functions with greater levels of confidence prior to first flight.

Author

Computerized Simulation; Flight Paths; Mathematical Models; Telemetry; Trajectory Control; X-33 Reusable Launch Vehicle

15
LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles. For related information see also 20 Spacecraft Propulsion and Power.

19990100644 NASA Marshall Space Flight Center, Huntsville, AL USA

Short Duration Base Heating Test Improvements

Bender, Robert L., Qualis Corp., USA; Dagostino, Mark G., NASA Marshall Space Flight Center, USA; Engel, Bradley A., Qualis Corp., USA; Engel, Carl D., Qualis Corp., USA; [1999]; 10p; In English; Test and Evaluation, 12-15 Oct. 1999, Tullahoma, TN, Tullahoma, TN, USA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Significant improvements have been made to a short duration space launch vehicle base heating test technique. This technique was first developed during the 1960's to investigate launch vehicle plume induced convective environments. Recent improvements include the use of coiled nitrogen buffer gas lines upstream of the hydrogen / oxygen propellant charge tubes, fast acting solenoid valves, stand alone gas delivery and data acquisition systems, and an integrated model design code. Technique improvements were successfully demonstrated during a 2.25% scale X-33 base heating test conducted in the NASA/MSFC Nozzle Test Facility in early 1999. Cost savings of approximately an order of magnitude over previous tests were realized due in large part to these improvements.

Author

Spacecraft Launching; X-33 Reusable Launch Vehicle; Base Heating; Test Facilities

19990100665 Iowa State Univ. of Science and Technology, Dept. of Aerospace Engineering and Engineering Mechanics, Ames, IA USA

Entry Guidance for the Reusable Launch Vehicle *Final Report, 5 Jan. 1997 - 6 Jul. 1999*

Lu, Ping, Iowa State Univ. of Science and Technology, USA; [1999]; 58p; In English

Contract(s)/Grant(s): NAG8-1289; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The X-33 Advanced Technology Demonstrator is a half-scale prototype developed to test the key technologies needed for a full-scale single-stage reusable launch vehicle (RLV). The X-33 is a suborbital vehicle that will be launched vertically, and land horizontally. The goals of this research were to develop an alternate entry guidance scheme for the X-33 in parallel to the actual X-33 entry guidance algorithms, provide comparative and complementary study, and identify potential new ways to improve entry guidance performance. Toward these goals, the nominal entry trajectory is defined by a piecewise linear drag-acceleration-versus-energy profile, which is in turn obtained by the solution of a semi-analytical parameter optimization problem. The closed-loop guidance is accomplished by tracking the nominal drag profile with primarily bank-angle modulation on-board. The bank-angle is commanded by a single full-envelope nonlinear trajectory control law. Near the end of the entry flight, the guidance logic is switched to heading control in order to meet strict conditions at the terminal area energy management interface. Two methods, one on ground-track control and the other on heading control, were proposed and examined for this phase of entry guidance where lateral control is emphasized. Trajectory dispersion studies were performed to evaluate the effectiveness of the entry guidance algorithms against a number of uncertainties including those in propulsion system, atmospheric properties, winds, aerodynamics, and propellant loading. Finally, a new trajectory-regulation method is introduced at the end as a promising precision entry guidance method. The guidance principle is very different and preliminary application in X-33 entry guidance simulation showed high precision that is difficult to achieve by existing methods.
Author
X-33 Reusable Launch Vehicle; Recoverable Launch Vehicles; Guidance (Motion); Flight Control; Trajectory Control; Vertical Takeoff; Entry Guidance (STS); Spacecraft Reentry

19990100868 NASA Marshall Space Flight Center, Huntsville, AL USA
Bantam: A Systematic Approach to Reusable Launch Vehicle Technology Development
Griner, Carolyn, NASA Marshall Space Flight Center, USA; Lyles, Garry, NASA Marshall Space Flight Center, USA; 1999; In English, 4-8 Oct. 1999, Amsterdam, Netherlands; Sponsored by International Astronomical Union, Netherlands
Contract(s)/Grant(s): RTOP 242-76-10; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche
The Bantam technology project is focused on providing a low cost launch capability for very small (100 kilogram) NASA and University science payloads. The cost goal has been set at one million dollars per launch. The Bantam project, however, represents much more than a small payload launch capability. Bantam represents a unique, systematic approach to reusable launch vehicle technology development. This technology maturation approach will enable future highly reusable launch concepts in any payload class. These launch vehicle concepts of the future could deliver payloads for hundreds of dollars per pound, enabling dramatic growth in civil and commercial space enterprise. The National Aeronautics and Space Administration (NASA) has demonstrated a better, faster, and cheaper approach to science discovery in recent years. This approach is exemplified by the successful Mars Exploration Program lead by the Jet Propulsion Laboratory (JPL) for the NASA Space Science Enterprise. The Bantam project represents an approach to space transportation technology maturation that is very similar to the Mars Exploration Program. The NASA Advanced Space Transportation Program (ASTP) and Future X Pathfinder Program will combine to systematically mature reusable space transportation technology from low technology readiness to system level flight demonstration. New reusable space transportation capability will be demonstrated at a small (Bantam) scale approximately every two years. Each flight demonstration will build on the knowledge derived from the previous flight tests. The Bantam scale flight demonstrations will begin with the flights of the X-34. The X-34 will demonstrate reusable launch vehicle technologies including; flight regimes up to Mach 8 and 250,000 feet, autonomous flight operations, all weather operations, twenty-five flights in one year with a surge capability of two flights in less than twenty-four hours and safe abort. The Bantam project will build on this initial capability to expand the capability of a reusable first stage, including ground launch, powered return to the launch site, and a fully reusable rocket propulsion system. A Bantam technology goal is to demonstrate twenty-five flights with no unplanned rocket engine maintenance and only minor planned maintenance or inspections. The design goal of the propulsion system is a mission life of one hundred.
Author
NASA Space Programs; Space Transportation; Technology Assessment; X-34 Reusable Launch Vehicle

19990102220 Lockheed Martin Corp., Skunk Works, Palmdale, CA USA
Overview of the X-33 Extended Flight Test Range
Mackall, D., Lockheed Martin Corp., USA; Sakahara, R., Lockheed Martin Corp., USA; Kremer, S., Lockheed Martin Corp., USA; 1998; In English; Telemetry, 26-29 Oct. 1998, San Diego, CA, USA
Contract(s)/Grant(s): NCC8-115; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
On July 1, 1996, the National Aeronautics and Space Administration signed a Cooperative Agreement No. NCC8-115 with Lockheed Martin Skunk Works to develop and flight test the X-33, a scaled version of a reusable launch vehicle. The development

of an Extended Test Range, with range instrumentation providing continuous vehicle communications from Edwards Air Force Base Ca. to landing at Malmstrom Air Force Base Montana, was required to flight test the mach 15 vehicle over 950 nautical miles. The cooperative agreement approach makes Lockheed Martin Skunk Works responsible for the X-33 program. When additional Government help was required, Lockheed "subcontracted" to NASA Field Centers for certain work. It was through this mechanism that Dryden Flight Research Center became responsible for the Extended Test Range. The Extended Test Range Requirements come from two main sources: 1) Range Safety and 2) Lockheed Martin Skunk Works. The range safety requirements were the most challenging to define and meet. The X-33 represents a vehicle that launches like a rocket, reenters the atmosphere and lands autonomously like an aircraft. Historically, rockets have been launched over the oceans to allow failed rockets to be destroyed using explosive devices. Such approaches had to be reconsidered for the X-33 flying over land. Numerous range requirements come from Lockheed Martin Skunk Works for interface definitions with the vehicle communication subsystems and the primary ground operations center, defined the Operations Control Center. Another area of considerable interest was the reentry plasma shield that causes "blackout" of the radio frequency signals, such as the range safety commands. Significant work was spent to analyze and model the blackout problem using a cooperative team of experts from across the country. The paper describes the Extended Test Range a, an unique Government/industry team of personnel and range assets was established to resolve design issues and accomplish the X-33 requirements. The paper will also provide an overview of the technical approaches used to meet program requirements. The advances used to develop the extended test range will be discussed to show how other hypersonic and Access to Space programs can benefit from the development of the extended test range. Acknowledgment: The work described in this paper was NASA supported through cooperative agreement NCC8-115 with Lockheed Martin Skunk Works.
Author
Test Vehicles; Test Ranges; X-33 Reusable Launch Vehicle; Range Safety; Flight Tests; Reentry Shielding

19990102224 NASA Marshall Space Flight Center, Huntsville, AL USA
Status of the Advanced Reusable Technologies Project
Hueter, Ume, NASA Marshall Space Flight Center, USA; 1998; 1p; In English; International Space Planes and Hypersonic Systems and Technology, 27-30 Apr. 1998, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics
Report No.(s): AIAA Paper 98-1569; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Advanced Reusable Technologies (ART) Project, part of the Advanced Space Transportation Program Office at the NASA's Marshall Space Flight Center in Huntsville, Ala., focuses on future reusable technologies beyond those being pursued by X-33. The prime objective of the project is to dramatically reduce the cost of access to space. In April 1996, an NRA was issued soliciting proposals for tasks focusing on rocket-based combined cycle propulsion system (RBCC). In August of 1996, five contractors were selected for a two year period to design and ground test their RBCC engine concepts. The work on these contracts should be completed by the end of this year. In March of this year, another NRA was issued to solicit inputs for reusable vehicle and propulsion technologies applicable to earth-to-orbit and in-space transportation. The current RBCC effort is the first of three phases leading to a large scale flight demonstrations of the technology for space launch vehicle propulsion. This first phase will provide initial verification of proposed concepts through ground demonstration of combined rocket/air breathing propulsion technologies. Using the most promising concepts identified in the first phase, the second phase will design, manufacture and ground test flight-type engine(s) to demonstrate actual design weights and performance. In the third phase, the first flight of a sub-scale integrated X-vehicle is planned for 2002. This paper describes the current status, plans and progress of the ART Project.
Author
X-33 Reusable Launch Vehicle; Propulsion; Ground Tests; Engine Design; Technology Assessment

19990102412 NASA Marshall Space Flight Center, Huntsville, AL USA
Guidance and Control Concepts for the X-33 Technology Demonstrator
Dukeman, Gregory A., NASA Marshall Space Flight Center, USA; Gallaher, Michael W., NASA Marshall Space Flight Center, USA; 1998; In English; 1998 Guidance and Control, 4-8 Feb. 1998, Breckenridge, CO, USA; Sponsored by American Astronomical Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The X-33 technology demonstrator is a suborbital precursor to the Reusable Launch Vehicle (RLV) with first flight planned for summer of 1999. The flight test program will include about 15 flights originating from Edwards Air Force Base, California, each with widely varying flight profiles in order to test new thermal protection system (TPS) materials, structures, and linear aerospike engines. The first flights will be relatively short range flights with about a 300 nmi range, maximum Mach number of 7, maximum altitude of 190,000 feet, whereas the latter flights will cover about 800 nmi range, with max altitude of about 260,000 feet and max Mach of about 15. The guidance algorithms must be flexible enough to accommodate these various profiles and to adapt to severe off-nominal dispersions, such as early engine failure (partial or total) where possibly more than half the thrust is lost. An onboard real-time performance monitor will be used to assess the viability of the nominal landing site as well as alternate

landing sites that would potentially be used in extreme off-nominal conditions. During ascent, a single entry guidance-related parameter, which is easy to calculate, is used to assess the viability of the nominal landing site as well as alternate landing sites. Real-time adjustment of the stored ascent attitude profile will be performed, as required, to maximize the probability of making it to the nominal landing site. Numerical results are given for various engine-out cases to illustrate the adaptability of the performance monitor.

Author

Control Theory; Aircraft Guidance; Aircraft Control; X-33 Reusable Launch Vehicle

19990103022 NASA Marshall Space Flight Center, Huntsville, AL USA

Friction Stir Welding of Large Scale Cryogenic Tanks for Aerospace Applications

Russell, Carolyn, NASA Marshall Space Flight Center, USA; Ding, R. Jeffrey, NASA Marshall Space Flight Center, USA; 1998; In English; Aeromat 1998, 15-18 Jun. 1998, McLean, VA, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Marshall Space Flight Center (MSFC) has established a facility for the joining of large-scale aluminum cryogenic propellant tanks using the friction stir welding process. Longitudinal welds, approximately five meters in length, have been made by retrofitting an existing vertical fusion weld system, designed to fabricate tank barrel sections ranging from two to ten meters in diameter. The structural design requirements of the tooling, clamping and travel system will be described in this presentation along with process controls and real-time data acquisition developed for this application. The approach to retrofitting other large welding tools at MSFC with the friction stir welding process will also be discussed.

Author

Friction Welding; Fusion Welding; Retrofitting; Storage Tanks; Structural Design

19990104359 NASA Marshall Space Flight Center, Huntsville, AL USA

Efficient GO2/GH2 Injector Design: A NASA, Industry and University Cooperative Effort

Tucker, P. K., NASA Marshall Space Flight Center, USA; Klem, M. D., NASA Lewis Research Center, USA; Fisher, S. C., Rockwell International Corp., USA; Santoro, R. J., Pennsylvania State Univ., USA; 1997; 1p; In English; 33rd; Joint Propulsion, 6-9 Jul. 1997, Seattle, WA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Developing new propulsion components in the face of shrinking budgets presents a significant challenge. The technical, schedule and funding issues common to any design/development program are complicated by the ramifications of the continuing decrease in funding for the aerospace industry. As a result, new working arrangements are evolving in the rocket industry. This paper documents a successful NASA, industry, and university cooperative effort to design efficient high performance GO2/GH2 rocket injector elements in the current budget environment. The NASA Reusable Launch Vehicle (RLV) Program initially consisted of three vehicle/engine concepts targeted at achieving single stage to orbit. One of the Rocketdyne propulsion concepts, the RS 2100 engine, used a full-flow staged-combustion cycle. Therefore, the RS 2100 main injector would combust GO2/GH2 propellants. Early in the design phase, but after budget levels and contractual arrangements had been set the limitations of the current gas/gas injector database were identified. Most of the relevant information was at least twenty years old. Designing high performance injectors to meet the RS 2100 requirements would require the database to be updated and significantly enhanced. However, there was no funding available to address the need for more data. NASA proposed a teaming arrangement to acquire the updated information without additional funds from the RLV Program. A determination of the types and amounts of data needed was made along with test facilities with capabilities to meet the data requirements, budget constraints, and schedule. After several iterations a program was finalized and a team established to satisfy the program goals. The Gas/Gas Injector Technology (GGIT) Program had the overall goal of increasing the ability of the rocket engine community to design efficient high-performance, durable gas/gas injectors relevant to RLV requirements. First, the program would provide Rocketdyne with data on preliminary gas/gas injector designs which would enable discrimination among candidate injector designs. Secondly, the program would enhance the national gas/gas database by obtaining high-quality data that increases the understanding of gas/gas injector physics and is suitable for computational fluid dynamics (CFD) code validation. The third program objective was to validate CFD codes for future gas/gas injector design in the RLV program.

Author

Data Bases; Gas-Gas Interactions; Injectors; Fuel Injection; Gas Injection

NASA Marshall Space Flight Center, Huntsville, AL USA
The Lifting Body Legacy...X-33
Barret, Chris, NASA Marshall Space Flight Center, USA; [1999]; In English; 37th Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

   NASA has a technology program in place to enable the development of a next generation Reusable Launch Vehicle that will carry our future payloads into orbit at a much-reduced cost. The VentureStar, Lifting Body (LB) flight vehicle, is one of the potential reusable launch vehicle configurations being studied. A LB vehicle has no wings and derives its lift solely from the shape of its body, and has the unique advantages of superior volumetric efficiency, better aerodynamic efficiency at high angles-of-attack and hypersonic speeds, and reduced thermal protection system weight. Classically, in a ballistic vehicle, drag has been employed to control the level of deceleration in reentry. In the LB, lift enables the vehicle to decelerate at higher altitudes for the same velocity and defines the reentry corridor which includes a greater cross range. This paper outlines the flight stability and control aspects of our LB heritage which was utilized in the design of the VentureStar LB and its test version, the X-33. NASA and the U.S. Air Force have a rich heritage of LB vehicle design and flight experience. In the initial LB Program, eight LB's were built and over 225 LB test flights were conducted through 1975. Three LB series were most significant in the advancement of today's LB technology: the M2-F; the HL-10; and the X-24 series. The M2-F series was designed by NASA Ames Research Center, the HL-10 series by NASA Langley Research Center, and the X-24 series by the U. S. Air Force. LB vehicles are alive again today with the X- 33, X-38, and VentureStar.
Author
Angle of Attack; Deceleration; Drag; Launch Vehicle Configurations; Lifting Bodies; X-33 Reusable Launch Vehicle; X-38 Crew Return Vehicle

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SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques. for related information see also 03 Air Transportation and Safety and 18 Spacecraft Design, Testing and Performance. For space suits see 54 Man/System Technology and Life Support

NASA Marshall Space Flight Center, Huntsville, AL USA
Economic Analysis on the Space Transportation Architecture Study (STAS) NASA Team
Shaw, Eric J., NASA Marshall Space Flight Center, USA; 1999; 8p; In English; Space Technology, 28-30 Sep. 1999, Albuquerque, NM, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA
Report No.(s): AIAA Paper 99-4546; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

   The National Aeronautics and Space Administration (NASA) performed the Space Transportation Architecture Study (STAS) to provide information to support end-of-the-decade decisions on possible near-term US Government (USG) investments in space transportation. to gain a clearer understanding of the costs and benefits of the broadest range of possible space transportation options, six teams, five from aerospace industry companies and on internal to NASA, were asked to answer three primary questions: 1) if the Space Shuttle system should be replaced; 2) if so, when the replacement should take place and how the transition should be implemented; and 3) if not, what is the upgrade strategy to continue safe and affordable flight of the Space Shuttle beyond 2010. The overall goal of the study was "to develop investment options to be considered by the Administration for the President's FY2001 budget to meet NASA's future human space flight requirements with significant reductions in costs." This emphasis on participation by commercial firms, required an unprecedented level of economic analysis of costs and benefits from both industry and government viewpoints. This paper will discuss the economic and market models developed by the in-house NASA Team to analyze space transportation architectures, the results of those analyses, and how those results were reflected in the conclusions and recommendations of the STAS NASA Team.
Author
Economic Analysis; Costs; Cost Analysis; Space Transportation System; NASA Programs; Space Shuttles

Smithsonian Astrophysical Observatory, Cambridge, MA USA
In-Space Transportation with Tethers *Final Report, 1 Sep. 1996 - 15 Mar. 1999*
Lorenzini, Enrico C., Smithsonian Astrophysical Observatory, USA; September 1999; 206p; In English
Contract(s)/Grant(s): NAG8-1303; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

Any analysis of electrodynamic tethers for Space Station applications will soon arrive at the conclusion that currents on the order of 10 A are required. For power generation, we have to foresee needs of several kilowatts even for an emergency backup system. For reboost, we need thrust forces on the order of a Newton, due to the large aerodynamic drag of the Station. In addition, we are restricted by the need to keep perturbations to the Station environment to a minimum. Very long tethers are ruled out by this condition, as they would move the system's center of gravity too much and pose additional operational problems when the Station is docking with other spacecraft. It is easy to show that "standard" tether systems, such as TSS-1, which rely on a large spherical surface to collect electron current from the ionosphere, are unsuitable for ISS applications. A study conducted by MSFC into the possible use of the TSS - 1/R system on the Space Station came to the conclusion that it did not make sense. A quick calculation, using the 10 A benchmark, shows why. TSS-LR collected I A, while the satellite was biased to 1.5 kV. This was twice what had been predicted. Even so, the current collected by the satellite was observed to increase only as the square root of the bias voltage. Thus, to achieve 10 A with the TSS-1 system under the same (daytime) conditions would require a bias voltage of 150 kV, or a tether length of over 850 km! Going to a larger surface would help some, but there is a strong law of diminishing returns for that route. Even if very large spheres were to be allowed (say of 8 m radius), which might achieve useful power levels during optimal conditions of daytime plasma densities with a tether 10 km long, they would suffer from the other Achilles heel of passive spherical collectors: a strong drop in the current (and power goes as the square of the current), as the low plasma densities are encountered during the third of the orbit which is in the Earth's shadow.

Derived from text

Tethering; Electrodynamics; International Space Station; Transportation; Operational Problems; Aerodynamic Drag

19990102610 NASA Marshall Space Flight Center, Huntsville, AL USA

Technology Maturity Towards Highly Reusable Space Transportation Goals

Lyles, Garry, NASA Marshall Space Flight Center, USA; 1999; In English, 4-8 Oct. 1999, Amsterdam, Netherlands; Sponsored by International Astronautical Federation; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The National Aeronautics and Space Administration's (NASA) Advanced Space Transportation Program (ASTP) has advanced key propulsion and launch vehicle systems technologies towards enabling the concepts identified by the Highly Reusable Space Transportation (HRST) Study as having significant potential for reducing the cost of access to space. The Marshall Space Flight Center (MSFC) manages the ASTP for the NASA Aero-Space Technology Enterprise. The HRST Study was conducted from 1995 through 1997 to evaluated launch concepts with the potential to reduce launch cost to $100 to $200 per pound of payload to low Earth orbit in the 2016 to 2022 timeframe. The HRST represents a generation of launch vehicles beyond the Lockheed-Martin VentureStar concept with a goal of another factor of ten reduction in launch cost below the next generation Reusable Launch Vehicle. Several concepts were developed and evaluated during the initial HRST studies. At the completion of the concept development phase in 1997, four task forces were formed to integrate the results of the study. These task forces were System Concept Definition, Operations Assessment. Cost Assessment and Technology Assessment. The Operations Assessment task force published its final report in November 1998. The Operations Assessment task force evaluated both single stage to orbit (SSTO) and two-stage to orbit (TSTO) concepts. SSTO concepts included horizontal takeoff and horizontal landing, vertical takeoff and vertical landing and vertical takeoff and horizontal landing. Horizontally launched concepts including launch assist options. SSTO concepts included airbreathing and all rocket as well as combination propulsion systems. The Operations Assessment considered the significance of performance margin, flight rate capability, reliability, launch assist, design optimization and technology development. These studies serve as a guide for the ASTP to prioritize technology development towards future highly reusable launch systems. Although the ASTP supports the development of technology that is focused at a near term fully reusable launch vehicle, the core of the technology development is looking ahead to future generations of launch vehicles that will enable dramatic growth in civil and commercial space enterprise. The primary focus of the paper is to status the key enabling technologies including rocket based combined cycle (RBCC) propulsion, magnetic launch assist, long life, low weight rocket propulsion, integral hot structures. robust thermal protection systems and integrated vehicle health management. The ASTP technology roadmap is leading rapidly towards system demonstration and eventual future X vehicle flight demonstrations.

Author

NASA Space Programs; Reusable Launch Vehicles; Space Transportation; Single Stage to Orbit Vehicles; Technology Assessment; Technology Utilization

19990103066 National Aerospace Lab., Tokyo Japan

Conceptual Study for Improving the Efficiency of the Return Flight Path Design of the Space Shuttle

Hara, Y.; Ito, F.; Suematsu, S.; Oct. 1998; 36p; In Japanese; Portions of this document are not fully legible

Report No.(s): PB99-169591; NAL-TR-1365; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The return flight path of the space shuttle used to be designed through parametric iteration to reduce the gaps at the interface points of the two adjacent flight paths, of different flight phases of reentry, TAEM (Terminal Area Energy Management) and AL (Approach Landing), which are maneuvered by the guidance program. This research shows that the return flight path can be deduced from the gliding performance which is determined by the lift/drag ratio (L/D), where L/D is controlled by the angle of attack, the speed brake angle and the bank angle, and that an algorithm to determine the return flight path corridor depending on the gliding capability of the vehicle can be derived.

NTIS

Flight Paths; Space Shuttles; Spacecraft Reentry; Aircraft Approach Spacing; Approach Control; Reentry Guidance; Reentry Vehicles; Gliding; Glide Paths; Return to Earth Space Flight

19990104360 NASA Marshall Space Flight Center, Huntsville, AL USA

A Technology Plan for Enabling Commercial Space Business

Lyles, Garry M., NASA Marshall Space Flight Center, USA; 1997; 1p; In English, 6-10 Oct. 1997, Turin, Italy; Sponsored by International Astronautical Congress; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The National Aeronautics and Space Administration's (NASA) Advanced Space Transportation Program is a customer driven, focused technology program that supports the NASA Strategic Plan and considers future commercial space business projections. The initial cycle of the Advanced Space Transportation Program implementation planning was conducted from December 1995 through February 1996 and represented increased NASA emphasis on broad base technology development with the goal of dramatic reductions in the cost of space transportation. The second planning cycle, conducted in January and February 1997, updated the program implementation plan based on changes in the external environment, increased maturity of advanced concept studies, and current technology assessments. The program has taken a business-like approach to technology development with a balanced portfolio of near, medium, and long-term strategic targets. Strategic targets are influenced by Earth science, space science, and exploration objectives as well as commercial space markets. Commercial space markets include those that would be enhanced by lower cost transportation as well as potential markets resulting in major increases in space business induced by reductions in transportation cost. The program plan addresses earth-to-orbit space launch, earth orbit operations and deep space systems. It also addresses all critical transportation system elements; including structures, thermal protection systems, propulsion, avionics, and operations. As these technologies are matured, integrated technology flight experiments such as the X-33 and X-34 flight demonstrator programs support near-term (one to five years) development or operational decisions. The Advanced Space Transportation Program and the flight demonstrator programs combine business planning, ground-based technology demonstrations and flight demonstrations that will permit industry and NASA to commit to revolutionary new space transportation systems beginning at the turn of the century and continuing far into the future.

Author

Aerospace Industry; Commerce; NASA Space Programs; Space Commercialization; Space Transportation; Space Transportation System

19990104608 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Space Transportation: Status of the X-33 Reusable Launch Vehicle Program

Aug. 1999; 36p; In English; Report to Congressional Requesters.

Report No.(s): AD-A367271; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of the $1.3 billion X-33 Program, cosponsored by the National Aeronautics and Space Administration (NASA) and the Lockheed Martin Corporation, is to develop and demonstrate advanced technologies and techniques needed for future reusable launch vehicles (RLV), including lightweight internal fuel tanks, advanced rocket engines, a durable heat shield, and rapid-turnaround, low-cost operations. The X-33 vehicle will be a half-scale model of Lockheed Martin's planned single-stage-to-orbit (SSTO) Venture Star RLV, an operational vehicle that will be based on and developed after the X-33. Lockheed Martin and NASA will base the decision to proceed with developing the Venture Star, in part, on the results of the X-33 Program. NASA would potentially be one of Lockheed Martin's primary customers for the cargo-only flights and, at this time, is the only anticipated customer for passenger flights. The passenger flights would carry crewmembers to and from the International Space Station.

DTIC

Fuel Tanks; Heat Shielding; Rocket Engines; Launch Vehicles

19990105702 NASA Marshall Space Flight Center, Huntsville, AL USA

Analytical Assessment of a Gross Leakage Event Within the International Space Station (ISS) Node 2 Internal Active Thermal Control System (IATCS)

Holt, James M., NASA Marshall Space Flight Center, USA; Clanton, Stephen E., Sverdrup Technology, Inc., USA; 1999; 1p; In

English; 10th; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Results of the International Space Station (ISS) Node 2 Internal Active Thermal Control System (IATCS) gross leakage analysis are presented for evaluating total leakage flowrates and volume discharge caused by a gross leakage event (i.e. open boundary condition). A Systems Improved Numerical Differencing Analyzer and Fluid Integrator (SINDA/FLUINT) thermal hydraulic mathematical model (THMM) representing the Node 2 IATCS was developed to simulate system performance under steady-state nominal conditions as well as the transient flow effects resulting from an open line exposed to ambient. The objective of the analysis was to determine the adequacy of the leak detection software in limiting the quantity of fluid lost during a gross leakage event to within an acceptable level.

Author

Thermal Analysis; Leakage; Temperature Control; Mathematical Models; Numerical Analysis; Detection; Active Control

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SPACE COMMUNICATIONS, SPACECRAFT COMMUNICATIONS, COMMAND AND TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout. For related information see also 04 Aircraft Communications and Navigation and 32 Communications and Radar.

19990100678 BBN Systems and Technologies Corp., Cambridge, MA USA

Study and Simulation of Enhancements for TCP Performance Over Noisy High Latency Links *Final Report*

Partridge, Craig, BBN Systems and Technologies Corp., USA; August 1999; 92p; In English

Contract(s)/Grant(s): NAS3-96014; RTOP 632-50-5A

Report No.(s): NASA/CR-1999-209167; NAS 1.26:209167; E-11761; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The goal of this study is to better understand how TCP behaves over noisy, high-latency links such as satellite links and propose improvements to TCP implementations such that TCP might better handle such links. This report is comprised of a series of smaller reports, presentations and recommendations. Included in these documents are a summary of the TCP enhancement techniques for large windows, protect against wrap around (PAWS), use of selective acknowledgements (SACK), increasing TCP's initial window and recommendations to implement TCP pacing.

Author (revised)

Research; Computerized Simulation; Augmentation; Data Links

18
SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls. For life support systems see 54 Man/System Technology and Life Support. For related information see also 05 Aircraft Design, Testing and Performance, 39 Structural Mechanics, and 16 Space Transportation.

19990099686 NASA Marshall Space Flight Center, Huntsville, AL USA

Materials Science Experiments on the International Space Station

Gillies, Donald C., NASA Marshall Space Flight Center, USA; 1999; In English, 7-12 Mar. 1999, Orlando, FL, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Performance Goal for NASA's Microgravity Materials Science Program reads "Use microgravity to establish and improve quantitative and predictive relationships between the structure, processing and properties of materials." The advent of the International Space Station will open up a new era in Materials Science Research including the ability to perform long term and frequent experiments in microgravity. As indicated the objective is to gain a greater understanding of issues of materials science in an environment in which the force of gravity can be effectively switched off. Thus gravity related issues of convection, buoyancy and hydrostatic forces can be reduced and the science behind the structure/processing/properties relationship can more easily be understood. The specific areas of research covered within the program are (1) the study of Nucleation and Metastable States, (2) Prediction and Control of Microstructure (including pattern formation and morphological stability), (3) Phase Separation and Interfacial Stability, (4) Transport Phenomena (including process modeling and thermophysical properties measurement), and (5) Crystal Growth, and Defect Generation and Control. All classes of materials, including metals and alloys, glasses and ceramics, polymers, electronic materials (including organic and inorganic single crystals), aerogels and nanostructures, are

included in these areas. The principal experimental equipment available to the materials scientist on the International Space Station (ISS) will be the Materials Science Research Facility (MSRF). Each of these systems will be accommodated in a single ISS rack, which can operate autonomously, will accommodate telescience operations, and will provide real time data to the ground. Eventual plans call for three MSRF racks, the first of which will be shared with the European Space Agency (ESA). Under international agreements, ESA and other partners will provide some of the equipment, while NASA covers launch and integration costs. The MSRF facilities will include modular components, which can be exchanged to provide inserts specifically matched to the engineering requirements of the particular Principal Investigator. to defray costs and avoid duplication of engineering effort NASA is also pursuing the possibility of using facilities provided by international partners. by this means it is anticipated that all of the types of research outlined in the previous paragraph can be done on the ISS.
Author
International Space Station; Microgravity; Thermophysical Properties

19990100675 NASA Marshall Space Flight Center, Huntsville, AL USA
Spacecraft Environments Interactions: Space Radiation and Its Effects on Electronic Systems
Howard, J. W, Jr., Computer Sciences Corp., USA; Hardage, D. M., NASA Marshall Space Flight Center, USA; July 1999; 34p; In English; Original contains color illustrations
Report No.(s): NASA/TP-1999-209373; NAS 1.60:209373; M-929; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The natural space environment is characterized by complex and subtle phenomena hostile to spacecraft. Effects of these phenomena impact spacecraft design, development, and operation. Space systems become increasingly susceptible to the space environment as use of composite materials and smaller, faster electronics increases. This trend makes an understanding of space radiation and its effects on electronic systems essential to accomplish overall mission objectives, especially in the current climate of smaller/better/cheaper faster. This primer outlines the radiation environments encountered in space, discusses regions and types of radiation, applies the information to effects that these environments have on electronic systems, addresses design guidelines and system reliability, and stresses the importance of early involvement of radiation specialists in mission planning, system design, and design review (part-by-part verification).
Author
Extraterrestrial Radiation; Spacecraft Environments; Design Analysis; Electronic Equipment; Reliability

19990102214 NASA Goddard Space Flight Center, Greenbelt, MD USA
Automated Flight Dynamics Product Generation for the EOS AM-1 Spacecraft
Matusow, Carla, NASA Goddard Space Flight Center, USA; 1999; 3p; In English; 2nd; Spacecraft Ground Control and Data Systems (SCD 2), 8-12 Feb. 1999, Foz do Iguacu, Brazil; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

As part of NASA's Earth Science Enterprise, the Earth Observing System (EOS) AM-1 spacecraft is designed to monitor long-term, global, environmental changes. Because of the complexity of the AM-1 spacecraft, the mission operations center requires more than 80 distinct flight dynamics products (reports). to create these products, the AM-1 Flight Dynamics Team (FDT) will use a combination of modified commercial software packages (e.g., Analytical Graphic's Satellite ToolKit) and NASA-developed software applications. While providing the most cost-effective solution to meeting the mission requirements, the integration of these software applications raises several operational concerns: (1) Routine product generation requires knowledge of multiple applications executing on variety of hardware platforms. (2) Generating products is a highly interactive process requiring a user to interact with each application multiple times to generate each product. (3) Routine product generation requires several hours to complete. (4) User interaction with each application introduces the potential for errors, since users are required to manually enter filenames and input parameters as well as run applications in the correct sequence. Generating products requires some level of flight dynamics expertise to determine the appropriate inputs and sequencing. to address these issues, the FDT developed an automation software tool called AutoProducts, which runs on a single hardware platform and provides all necessary coordination and communication among the various flight dynamics software applications. AutoProducts, autonomously retrieves necessary files, sequences and executes applications with correct input parameters, and deliver the final flight dynamics products to the appropriate customers. Although AutoProducts will normally generate pre-programmed sets of routine products, its graphical interface allows for easy configuration of customized and one-of-a-kind products. Additionally, AutoProducts has been designed as a mission-independent tool, and can be easily reconfigured to support other missions or incorporate new flight dynamics software packages. After the AM-1 launch, AutoProducts will run automatically at pre-determined time intervals . The AutoProducts tool reduces many of the concerns associated with the flight dynamics product generation. Although AutoProducts required a significant effort to develop because of the complexity of the interfaces involved, its use will provide significant cost savings through

reduced operator time and maximum product reliability. In addition, user satisfaction is significantly improved and flight dynamics experts have more time to perform valuable analysis work. This paper will describe the evolution of the AutoProducts tool, highlighting the cost savings and customer satisfaction resulting from its development. It will also provide details about the tool including its graphical interface and operational capabilities.
Author
Applications Programs (Computers); EOS Data and Information System; Graphical User Interface; Human-Computer Interface; Software Engineering

19990102618 NASA Marshall Space Flight Center, Huntsville, AL USA
VON and Its Use in NASA's International Space Station Science Operation
Bradford, Robert N., NASA Marshall Space Flight Center, USA; Chamberlain, Jim, AZ Technology; 1999; 1p; In English; Voice Over the Net (VON) 1999, 27-30 Sep. 1999, Atlanta, GA, USA
Contract(s)/Grant(s): Proj. 479-44; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
     This presentation will provide a brief overview of a International Space Station (ISS) remote user (scientist/experimenter) operation. Specifically, the presentation will show how Voice over IP (VoIP) is integrated into the ISS science payload operation and in the mission voice system. Included will be the details on how a scientist, using VON, will talk to the ISS onboard crew and ground based cadre from a scientist's home location (lab, office or garage) over tile public Internet and science nets. Benefit(s) to tile ISS Program (and taxpayer) and of VoIP versus other implementations also will be presented.
Author
International Space Station; Payloads; Networks

19990102927 Aerospace Corp., Engineering and Technology Group, El Segundo, CA USA
Guidelines for Design and Analysis of Large, Brittle Spacecraft Components
Robinson, E. Y., Aerospace Corp., USA; Sep. 01, 1993; 118p; In English
Contract(s)/Grant(s): NASA Order T-9315-R
Report No.(s): ATR-93(3827-1; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche
     There were two related parts to this work. The first, conducted at The Aerospace Corporation was to develop and define methods for integrating the statistical theory of brittle strength with conventional finite element stress analysis, and to carry out a limited laboratory test program to illustrate the methods. The second part, separately funded at Aerojet Electronic Systems Division, was to create the finite element postprocessing program for integrating the statistical strength analysis with the structural analysis. The second part was monitored by Capt. Jeff McCann of USAF/SMC, as Special Study No.11, which authorized Aerojet to support Aerospace on this work requested by NASA. This second part is documented in Appendix A. The activity at Aerojet was guided by the Aerospace methods developed in the first part of this work. This joint work of Aerospace and Aerojet stemmed from prior related work for the Defense Support Program (DSP) Program Office, to qualify the DSP sensor main mirror and corrector lens for flight as part of a shuttle payload. These large brittle components of the DSP sensor are provided by Aerojet. This document defines rational methods for addressing the structural integrity and safety of large, brittle, payload components, which have low and variable tensile strength and can suddenly break or shatter. The methods are applicable to the evaluation and validation of such components, which, because of size and configuration restrictions, cannot be validated by direct proof test.
Derived from text
Design Analysis; Spacecraft Components; Statistical Analysis; Stress Analysis; Structural Analysis

19990103067 National Aerospace Lab., Structures Div., Tokyo, Japan
Technical Report of National Aerospace Laboratory. Effects of Rolling Elasticity on Flutter Characteristics at Launching Configuration of Re-entry Space Vehicle
Kanda, A.; Ueda, T.; Jan. 1999; 30p; In Japanese; Original contains color illustrations
Report No.(s): PB99-169583; NAL-TR-1380; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy
     The experimental winged space vehicle 'HOPE-X' project is progressing. An elastic-rolling mode may be involved in the dynamic characteristics of the launching configuration of this vehicle which is attached to the H-II rocket. Flutter experiments of a HOPE-like configuration model were made in a transonic wind tunnel. As a result, a wing bending-torsional mode flutter occurred in anti-symmetric mode. It was observed that the flutter occurred at lower dynamic pressure in the case of elastic support for roll than in the roll-free case. This type of flutter was confirmed by numerical analyses with the unsteady aerodynamic forces by DPM (Doublet-Point Method).
NTIS
Roll; Flutter Analysis; Elastic Properties; Spacecraft Launching; Wind Tunnel Tests; Aerospace Planes

19990103148 NASA Marshall Space Flight Center, Huntsville, AL USA

Development of an Environmental Monitoring Package for the International Space Station

Carruth, Ralph M., Jr., NASA Marshall Space Flight Center, USA; Clifton, Kenneth S., NASA Marshall Space Flight Center, USA; Vanhooser, Michael T., NASA Marshall Space Flight Center, USA; [1999]; 4p; In English; 37th; Aerospace Sciences, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The first elements of the International Space Station (ISS) will soon be launched into space and over the next few years ISS will be assembled on orbit into its final configuration. Experiments will be performed on a continuous basis both inside and outside the station. External experiments will be mounted on attached payload locations specifically designed to accommodate experiments and provide data and power from ISS. From the beginning of the space station program it has been recognized that external experiments will require knowledge of the external environment because it can affect the science being performed and may impact lifetime and operations of the experiments. Recently an effort was initiated to design and develop an Environment Monitoring Package (EMP) was started. This paper describes the derivation of the requirements for the EMP package, the type of measurements that the EMP will make and types of instruments which will be employed to make these measurements.
Author

Environmental Monitoring; International Space Station

19990103349 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Space Station Russian Commitment and Cost Control Problems

Aug. 1999; 27p; In English; Report to Congressional Requesters.

Report No.(s): AD-A367292; GAO/NSIAD-99-175; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) faces many challenges in developing and building the International Space Station (ISS). These challenges, such as Russian difficulty in completing its components on schedule due to insufficient funding and continuing U.S. prime contractor cost increases, have translated into schedule delays and higher program cost estimates to complete development. As requested, we reviewed the status of Russian involvement in the ISS program. We also examined the prime contractor's progress in implementing cost control measures and NASAs efforts to oversee the program's nonprime activity. Specifically, we (1) assessed NASAs progress in developing contingency plans to mitigate the possibility of Russian nonperformance and the loss or delay of other critical components, (2) identified NASAs efforts to ensure that Russian quality assurance processes meet the station's safety requirements, and (3) determined the effectiveness of cost control efforts regarding the prime contract and nonprime activities.
DTIC

Cost Estimates; Space Stations; Delay; Government Procurement; Contracts

19990104362 NASA Marshall Space Flight Center, Huntsville, AL USA

The International Space Station Assembly on Schedule

[1997]; 1p; In English

Contract(s)/Grant(s): NAS8-40836; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

As engineers continue to prepare the International Space Station (ISS) for in-orbit assembly in the year 2002, ANSYS software has proven instrumental in resolving a structural problem in the project's two primary station modules -- Nodes 1 and 2. Proof pressure tests performed in May revealed "low temperature, post-yield creep" in some of the Nodes' gussets, which were designed to reinforce ports for loads from station keeping and reboost motion of the entire space station. An extensive effort was undertaken to characterize the creep behavior of the 2219-T851 aluminum forging material from which the gussets were made. Engineers at Sverdrup Technology, Inc. (Huntsville, AL) were responsible for conducting a combined elastic-plastic-creep analysis of the gussets to determine the amount of residual compressive stress which existed in the gussets following the proof pressure tests, and to determine the stress-strain history in the gussets while on-orbit. Boeing, NASA's Space Station prime contractor, supplied the Finite Element Analysis (FEA) model geometry and developed the creep equations from the experimental data taken by NASA's Marshall Space Flight Center and Langley Research Center. The goal of this effort was to implement the uniaxial creep equations into a three dimensional finite element program, and to determine analytically whether or not the creep was something that the space station program could live with. The objective was to show analytically that either the creep rate was at an acceptable level, or that the node module had to be modified to lower the stress levels to where creep did not occur. The elastic-plastic-creep analysis was performed using the ANSYS finite element program of ANSYS, Inc. (Houston, PA). The analysis revealed that the gussets encountered a compressive stress of approximately 30,000 pounds per square inch (psi) when unloaded. This compressive residual stress significantly lowered the maximum tension stress in the gussets which decreased the creep strain rate. The analysis also showed that the gussets would not experience a great deal of creep from future pressure tests if braces or struts proposed by

Boeing were installed to redistribute stress away from them. Subsequent analysis of on-orbit station keeping and reboost loads convinced Boeing that the gussets should be removed altogether.

Derived from text

Creep Properties; International Space Station; Modules; Strain Rate; Stress-Strain Relationships; Inserts

19990104610 General Accounting Office, National Security and International Affairs Div., Washington, DC USA

Space Station Cost to Operate After Assembly Is Uncertain

Aug. 1999; 40p; In English; Report to Congressional Requesters.

Report No.(s): AD-A367281; GAO/NSIAD-99-177; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

When completed around 2004, the goal of the International Space Station (ISS) is to provide the USA and its international partners with an Earth orbiting facility that supports human habitation and scientific research in a microgravity environment. Because of Russia's ongoing problems in funding its share of the space station's construction costs, the National Aeronautics and Space Administration (NASA) is concerned that Russia may also not be able to fulfill its commitments to fund ISS operations costs. NASA estimated that the annual cost to operate the completed space station will average $1.3 billion, or $13 billion over a 10-year mission life. NASA anticipates sharing these costs with its international partners, and it hopes to further reduce funding requirements through sharing with commercial users or through more efficient commercial operations. As requested by you and the late Representative George E. Brown, Jr., we reviewed NASAs estimate for the cost to operate the space station after assembly is completed. Specifically, we were asked to determine (1) if any space station-related costs are not included in NASA's estimate; (2) the level of uncertainty in the cost estimate for operations, especially with regard to the potential impact of changes in Russian participation; and (3) how NASA funding requirements will be reduced by sharing costs with international partners or through commercial use and operations. We reported on NASA's efforts to promote commercial activity on the space station in a separate report to you.

DTIC

International Space Station; Construction; Structural Engineering; Costs; Cost Estimates; Cost Reduction; Space Commercialization; Space Manufacturing

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SPACECRAFT INSTRUMENTATION

For related information see also 06 Aircraft Instrumentation and 35 Instrumentation and Photography.

19990103948 NASA Marshall Space Flight Center, Huntsville, AL USA

The ISS EXPRESS Rack: An Innovative Approach of Rapid Integration

Sledd, Annette M., NASA Marshall Space Flight Center, USA; 2000; 1p; In English; Space Technology and Applications, 30 Jan. - 3 Feb. 2000, Albuquerque, NM, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The EXpedite the PRocessing of Experiments to Space Station or EXPRESS Rack System, was developed to provide Space Station accommodations for small, subrack payloads. The EXPRESS Rack accepts Space Shuttle middeck locker type payloads and International Subrack Interface Standard (ISIS) Drawer payloads, allowing previously flown payloads an opportunity to transition to the International Space Station. The EXPRESS Rack provides power, data, command and control, video, water cooling, air cooling, vacuum exhaust, and Nitrogen supply to payloads. The EXPRESS Rack system also includes transportation racks to transport payloads to and from the Space Station, Suitcase Simulators to allow a payload developer to verify power and data interfaces at the development site, Functional Checkout Units to allow Payload checkout at KSC prior to launch, and trainer racks for the astronauts to learn how to operate the EXPRESS Racks prior to flight. Standard hardware and software interfaces provided by the EXPRESS Rack simplify the analytical and physical integration processes, and facilitates simpler ISS payload development. The EXPRESS Rack has also formed the basis for the U.S. Life Sciences payload racks and the Window Observational Research Facility on Space Station.

Author

Accommodation; Product Development; Fabrication; Liquid Cooling; Research Facilities; Space Shuttle Payloads

19990104375 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Astro-E/XRS Blocking Filter Calibration

Audley, Michael D., Tokyo Univ., Japan; Arnaud, Keith A., NASA Goddard Space Flight Center, USA; Gendreau, Keith C., NASA Goddard Space Flight Center, USA; Boyce, Kevin R., NASA Goddard Space Flight Center, USA; Fleetwood, Charles M., NASA Goddard Space Flight Center, USA; Kelley, Richard L., NASA Goddard Space Flight Center, USA; Keski–Kuha, Ritva

A., NASA Goddard Space Flight Center, USA; Porter, F. Scott, NASA Goddard Space Flight Center, USA; Stahle, Caroline K., NASA Goddard Space Flight Center, USA; Szymkowiak, Andrew E., NASA Goddard Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We describe the transmission calibration of the Astro-E XRS blocking filters. The XRS instrument has five aluminized poly-imide blocking filters. These filters are located at thermal stages ranging from 200 K to 60 mK. They are each about 1000 A thick. XRS will have high energy resolution which will enable it to see some of the extended fine structure around the oxygen and aluminum K edges of these filters. Thus, we are conducting a high spectral resolution calibration of the filters near these energies to resolve out extended flue structure and absorption lines.

Author

Calibrating; Oxygen; Fine Structure; Blocking; Air Filters

19990104376 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Astro-E/XRS Calibration Program and Results

Gendreau, Keith C., NASA Goddard Space Flight Center, USA; Audley, M. Damian, Tokyo Univ., Japan; Arnaud, Keith A., NASA Goddard Space Flight Center, USA; Boyce, Kevin R., NASA Goddard Space Flight Center, USA; Fujimoto, Ryuichi, Tokyo Univ., Japan; Ishisaki, Yoshitaka, Tokyo Metropolitan Univ., Japan; Kelley, Richard L., NASA Goddard Space Flight Center, USA; Mihara, Tatehiro, Tokyo Metropolitan Univ., Japan; Mitsuda, Kazuhisa, Institute of Physical and Chemical Research, Japan; Porter, F. Scott, NASA Goddard Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

XRS is the microcalorimeter X-ray detector aboard the US-Japanese ASTRO-E observatory, which is scheduled to be launched in early 2000. XRS is a high resolution spectrometer- with less than 9 eV resolution at 3 keV and better than 14 eV resolution over its bandpass ranging from about 0.3 keV to 15 keV. Here we present the results of our first calibration of the XRS instrument. We describe the methods used to extract detailed information about the detection efficiency and spectral redistribution of the instrument. We also present comparison of simulations and read data to test our detector models.

Author

Calibrating; Calorimeters; X Ray Detectors; Spacecraft Equipment

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SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxiliary power sources. For related information see also 07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion, and 15 Launch Vehicles and Space Vehicles.

19990099681 NASA Marshall Space Flight Center, Huntsville, AL USA

Propulsion/ASME Rocket-Based Combined Cycle Activities in the Advanced Space Transportation Program Office

Hueter, Uwe, NASA Marshall Space Flight Center, USA; Turner, James, NASA Marshall Space Flight Center, USA; 1998; In English; Interagency Propulsion Committee, 7-11 Dec. 1998, Tucson, AZ, USA; Sponsored by Department of the Army, USA

Contract(s)/Grant(s): RTOP 242-72-01; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

NASA's Office of Aeronautics and Space Transportation Technology (OASTT) has establish three major coals. "The Three Pillars for Success". The Advanced Space Transportation Program Office (ASTP) at the NASA's Marshall Space Flight Center in Huntsville,Ala. focuses on future space transportation technologies under the "Access to Space" pillar. The Advanced Reusable Technologies (ART) Project, part of ASTP, focuses on the reusable technologies beyond those being pursued by X-33. The main activity over the past two and a half years has been on advancing the rocket-based combined cycle (RBCC) technologies. In June of last year, activities for reusable launch vehicle (RLV) airframe and propulsion technologies were initiated. These activities focus primarily on those technologies that support the year 2000 decision to determine the path this country will take for Space Shuttle and RLV. In February of this year, additional technology efforts in the reusable technologies were awarded. The RBCC effort that was completed early this year was the initial step leading to flight demonstrations of the technology for space launch vehicle propulsion. Aerojet, Boeing-Rocketdyne and Pratt & Whitney were selected for a two-year period to design, build and ground test their RBCC engine concepts. In addition, ASTROX, Pennsylvania State University (PSU) and University of Alabama in Huntsville also conducted supporting activities. The activity included ground testing of components (e.g., injectors, thrusters, ejectors and inlets) and integrated flowpaths. An area that has caused a large amount of difficulty in the testing efforts is the means of initiating the rocket combustion process. All three of the prime contractors above were using silane ($SiH4$) for ignition of the

thrusters. This follows from the successful use of silane in the NASP program for scramjet ignition. However, difficulties were immediately encountered when silane (an 80/20 mixture of hydrogen/silane) was used for rocket ignition.
Author (revised)
Space Transportation; Technology Assessment; X-33 Reusable Launch Vehicle; Performance Tests; Ground Tests; Engine Design

19990099689 NASA Marshall Space Flight Center, Huntsville, AL USA
Instellar Exploration: Propulsion Options for Precursors and Beyond
Johnson, Charles Les, NASA Marshall Space Flight Center, USA; Leifer, Stephanie, NASA Marshall Space Flight Center, USA; 1999; In English, 4-8 Oct. 1999, Amsterdam, Netherlands; Sponsored by International Astronautical Federation, Switzerland
Contract(s)/Grant(s): RTOP 242-76-10; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

NASA is considering a mission to explore near-interstellar space early in the next decade as the first step toward a vigorous interstellar exploration program. A key enabling technology for such an ambitious science and exploration effort is the development of propulsion systems capable of providing fast trip times; mission duration should not exceed the professional lifetime of the investigative team. Advanced propulsion technologies that might support an interstellar precursor mission early in the next century include some combination of solar sails, nuclear electric propulsion systems, and aerogravity assists. Follow-on missions to far beyond the heliopause will require the development of propulsion technologies that are only at the conceptual stage today. These include 1) matter-antimatter annihilation, 2) beamed-energy sails, and 3) fusion systems. For years, the scientific community has been interested in the development of solar sail technology to support exploration of the inner and outer planets. Progress in thin-film technology and the development of technologies that may enable the remote assembly of large sails in space are only now maturing to the point where ambitious interstellar precursor missions can be considered. Electric propulsion is now being demonstrated for planetary exploration by the Deep Space 1 mission. The primary issues for it's adaptation to interstellar precursor applications include the nuclear reactor that would be required and the engine lifetime. For further term interstellar missions, matter-antimatter annihilation propulsion system concepts have the highest energy density of any propulsion systems using onboard propellants. However, there are numerous challenges to production and storage of antimatter that must be overcome before it can be seriously considered for interstellar flight. Off-board energy systems (laser sails) are candidates for long-distance interstellar flight but development of component technologies and necessary infrastructure have not begun.. Fusion propulsion has been studied extensively. However, fusion technology is still considered immature, even after many decades of well-funded research. Furthermore, fusion alone does not offer high enough energy density to make it a viable candidate for interstellar propulsion unless propellant can be collected in situ, as was considered by R. Bussard for his interstellar ramjet concept. The current research in investigating these propulsion systems will be described, and the range of application of each technology will be explored.
Author
Interstellar Space; Propulsion System Configurations; Propulsion System Performance; Stellar Composition

19990099728 NASA Marshall Space Flight Center, Huntsville, AL USA
Propulsion Research and Technology at NASA MSFC
Schmidt, George R., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 34th; Joint Propulsion, 12-15 Jul. 1998, Cleveland, OH, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

As NASA's designated Center of Excellence in Space Propulsion, Marshall Space Flight Center (MSFC) recently established the Propulsion Research and Technology Division (PRTD), an organization responsible for the theoretical and experimental study of advanced propulsion concepts and technologies. Although the Scope of the division is broad, the mission is quite focused - to demonstrate the critical propulsion functions and technologies underpinning the transportation systems and spacecraft needed to achieve NASA's Grand Vision for exploration, commercial development, and ultimately human settlement of space. The division is intended to serve as a bridge that takes experimental stage of proof-of-concept. The aim is to address the key issues associated with promising high-payoff technologies, some of which were conceived decades ago, to where they can be seriously considered for advanced development. This paper describes the division's research strategy and summarizes its current activities.
Author
Propulsion; Research and Development; NASA Programs; Propellants

19990100638 Boeing Co., Space and Communications Group, Canoga Park, CA USA
STS-93 SSME Nozzle Tube Rupture Investigation
Romine, W. Dennis, Boeing Co., USA; 1999; 14p; In English; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-45000; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

STS-93 was launched on July 23, 1999. There was an anomaly at the end of the launch in that the main engines shut down 0.16 second early because sensors detected a low level of oxidizer in the LOX tank (actually the duct from the tank to the vehicle). This resulted in a cutoff velocity for the vehicle that was 16 ft/sec low. It should have been 25872 ft/sec. The OMS engines were subsequently used to achieve the proper orbit. An investigation was immediately initiated into the cause of this LOX tank low level cutoff. It was noticed during the launch that the turbine temperatures for Main Engine 3 (E2019) were approximately 100 F higher than the preflight prediction. Linear Engine Model matching of the data indicated that a nozzle leak best fit the data. Post launch review of the data showed, that at approximately five seconds into the start, numerous parameters indicated small anomalous shifts. These shifts were all consistent with a rupture of nozzle tubes. Post launch review of the films showed that just after Space Shuttle Main Engine (SSME) ignition and just prior to liftoff a streak is seen in the exhaust plume of E2019. Just after liftoff the streak can be seen emanating from the nozzle wall. This photo confirmed that a leak was coming from the nozzle tubes. Based on the photo, the axial location of the leak was estimated to be 28 in. from the aft end of the nozzle and in line with nozzle coolant feed line #1. The streak continued to be visible during the launch.
Derived from text
Anomalies; Combustion Chambers; Exhaust Gases; Ignition; Inspection; Leakage; Nozzle Walls; Space Transportation System

19990100866 NASA Marshall Space Flight Center, Huntsville, AL USA
Demonstrating the Performance Benefits of the Strutjet RBCC for Space Launch Architectures
Johnson, D., NASA Marshall Space Flight Center, USA; 1998; In English; Airbreathing Engines, 5-10 Sep. 1999, Florence, Italy
Contract(s)/Grant(s): NAS8-40891; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
The Rocket Based Combined Cycle (RBCC) engine synergistically combines the best elements of airbreathing and rocket propulsion to benefit a wide range of future reusable launch vehicles. Aerojet's Strutjet RBCC offers high I(sub sp) during mid-phase acceleration, and high thrust for boost and final ascent phases. The result is a relatively low gross weight vehicle with lower thrust requirements than comparable all-rocket solutions. Relative to combination propulsion systems, the integrated propulsive elements of the Strutjet reduce engine weight and complexity. In the recent NASA Highly Reusable Space Transportation (HRST) study, vehicles with RBCC-class engines were projected to have lower per flight operations costs than comparable rockets. The more benign operating environment of the RBCC engine primary rockets (2000 psi chamber pressure, lower internal temperatures, gas generator cycle) lead to longer service life, fewer maintenance actions, and increased reliability. Operations costs are typically the most significant contributor to life cycle costs. RBCC-powered vehicles lend themselves naturally to horizontal take-off, which typically requires less thrust for a given gross vehicle weight when compared to an all-rocket-powered vehicle. The lower thrust requirements reduce engine size and/or quantity, reducing the n of ground personnel and facilities required to maintain the vehicle. The reduced sensitivity to mass fraction also allows the vehicle to be designed with higher margins for improved life and reliability. Because of its multi-mode ascent operation and ability to perform long cruise segments, the strutjet RBCC offers RLV designers a chance to create vehicles with an unprecedented level of mission flexibility. Features such as supersonic cruise, flyback, off-set launch, self-ferry, horizontal takeoff and landing, multi-base operation, and flexible aborts open up a broad range of potential revenue producing missions. The Strutjet can lead to low-cost vehicle designs in traditional areas such as LEO cargo delivery and ISS resupply, and also lead to economically attractive vehicles for small payload missions difficult to achieve with all-rocket solutions. The performance capability of the Strutjet RBCC has been demonstrated in all operating mod underfunding from NASA MSFC and Aerojet as a result of over 1000testsand over 13 years of continuous development-a significant resource investment in the Strutjet engine design.
Derived from text
Air Breathing Engines; Engine Design; Flexibility; High Thrust; Propulsion System Configurations; Propulsion System Performance; Reliability; Thrust; Weight Reduction

19990101870 NASA Marshall Space Flight Center, Huntsville, AL USA
Simulation of Non-Acoustic Combustion Instability in a Hybrid Rocket Motor
Rocker, Marvin, NASA Marshall Space Flight Center, USA; [1999]; 17p; In English, 18-22 Oct. 1999, Cocoa Beach, FL, USA; Sponsored by Department of the Army, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
A transient model of a hybrid motor was formulated to study the cause and elimination of non-acoustic combustion instability. The transient model was used to simulate four key tests out of a series of seventeen hybrid motor tests conducted by Thiokol, Rocketdyne and Martin Marietta at NASA/Marshall Space Flight Center (NASAIMSFC). These tests were performed under the Hybrid Propulsion Technology for Launch Vehicle Boosters (HPTLVB) program. The first test resulted in stable combustion. The second test resulted in large-amplitude, 6.5 Hz chamber pressure oscillations that gradually damped away by the end of the test. The third test resulted in large-amplitude, 7.5 Hz chamber pressure oscillations that were sustained throughout the test. The seventh test resulted in the elimination of combustion instability with the installation of an orifice immediately upstream of the

injector. The formulation and implementation of the model are the scope of this presentation. The current model is an independent continuation of modeling presented previously by joint Thiokol-Rocketdyne collaborators Boardman, Hawkins, Wassom, and Claflin. The previous model simulated an unstable IR&D hybrid motor test performed by Thiokol. There was very good agreement between the model and the test data. Like the previous model, the current model was developed using Matrix-x simulation software. However, the tests performed at NASA/MSFC under the HPTLVB program were actually simulated. In the current model, the hybrid motor consisting of the liquid oxygen (LOX) injector, the multi-port solid fuel grain and the nozzle was simulated. Also, simulated in the model was the LOX feed system consisting of the tank, venturi, valve and feed lines. All components of the hybrid motor and LOX feed system are treated by a lumped-parameter approach. Agreement between the results of the transient model and the actual test data was very good. This agreement between simulated and actual test data indicated that the combustion instability in the hybrid motor was due to two causes. The first cause was a LOX feed system of insufficient stiffness. The second cause was a LOX injector with an impedance or pressure drop that was too low to provide damping against the feed system oscillations. Also, it was discovered that testing with a new grain of solid fuel sustained the combustion instability. However, testing with a used grain of solid fuel caused the combustion instability to gradually decay.

Author

Mathematical Models; Computerized Simulation; Launch Vehicles; Hybrid Propulsion; Fuel Combustion; Combustion Stability

19990102613 NASA Marshall Space Flight Center, Huntsville, AL USA

CVD Rhenium Engines for Solar-Thermal Propulsion Systems

Williams, Brian E., Ultramet Co., USA; Fortini, Arthur J., Ultramet Co., USA; Tuffias, Robert H., Ultramet Co., USA; Duffy, Andrew J., Ultramet Co., USA; Tucker, Stephen P., NASA Marshall Space Flight Center, USA; December 1999; In English; Renewable and Advanced Energy Systems for the 21st Century, 11-15 Apr. 1999, Mau, HI, USA

Contract(s)/Grant(s): NAS8-97236; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Solar-thermal upper-stage propulsion systems have the potential to provide specific impulse approaching 900 seconds, with 760 seconds already demonstrated in ground testing. Such performance levels offer a 100% increase in payload capability compared to state-of-the-art chemical upper-stage systems, at lower cost. Although alternatives such as electric propulsion offer even greater performance, the 6- to 18- month orbital transfer time is a far greater deviation from the state of the art than the one to two months required for solar propulsion. Rhenium metal is the only material that is capable of withstanding the predicted thermal, mechanical, and chemical environment of a solar-thermal propulsion device. Chemical vapor deposition (CVD) is the most well-established and cost-effective process for the fabrication of complex rhenium structures. CVD rhenium engines have been successfully constructed for the Air Force ISUS program (bimodal thrust/electricity) and the NASA Shooting Star program (thrust only), as well as under an Air Force SBIR project (thrust only). The bimodal engine represents a more long-term and versatile approach to solar-thermal propulsion, while the thrust-only engines provide a potentially lower weight/lower cost and more near-term replacement for current upper-stage propulsion systems.

Author

Vapor Deposition; Solar Propulsion; Electric Propulsion; Propulsion System Configurations; Propulsion System Performance; Specific Impulse; Propulsive Efficiency

19990102616 NASA Marshall Space Flight Center, Huntsville, AL USA

Using a Commerical off the Shelf Data Acquisition System for the Space Shuttle Solid Rocket Booster Program

Crawford, Kevin, NASA Marshall Space Flight Center, USA; Pinkleton, David, Boeing North America, Inc., USA; 1999; In English; Telemetering, 25-28 Oct. 1999, Las Vegas, NV, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The space shuttle solid rocket boosters (SRBs) experience a severe environment during their brief flight. During the last few years several SRB's have sustained noticeable structural damage. The environmental characteristics (vibration, structure, and thermal) encountered by the SRB's during ascent, descent and water impact are in most cases unknown. A developmental flight instrumentation (DFI) system collected data from the SRBs' first four flights in the early 1980's, and after the first three flights during the shuttle return-to-flight phase after the Challenger accident. However, the DFI data collected are of low fidelity and do not correlate well with cases of observed structural damage. The DFI system was evaluated for reuse, but the cost to fly it was prohibitive. The space shuttle is presently scheduled to fly until 2030. To support the shuttle flight schedule, avionics on the SRB's will be upgraded. The environments on the different sections of the SRB will need to be defined more completely to properly qualify the avionics for multiple flights. The DFI data previously gathered do not provide enough information to properly qualify the avionics. Marshall Space Flight Center's (MSFC) SRB Project Office requested the Science and Engineering (S&E) Directorate to develop a stand-alone data acquisition system that could collect data from any area of the booster. In answer to this requirement, S&E developed the Enhanced Data Acquisition System (EDAS). to minimize development time and cost, the development team used state-of-the-art commercial off the shelf (COTS) equipment. The first two flights of this system occurred on shuttle

mission STS-91 in June 1998 and STS-95 in October 1998. Twenty-one measurements were successfully recorded on the STS-91 right hand booster, providing new accelerometer, strain, temperature, and heating rate data to analysts. Twenty-four measurements were successfully recorded on the STS-95 left hand booster, providing data from the booster and the external tank. This paper summarizes the effort to develop, test, qualify and fly the EDAS to meet SRB flight and data collection requirements.
Author

Data Acquisition; Data Systems; Space Shuttle Boosters; Structural Failure; Damage; Damage Assessment; Spacecraft Structures; Spacecraft Survivability

19990102864 Aerojet, Propulsion Div., Sacramento, CA USA
Strutjet RBCC Engine Performance
Bulman, Mel, Aerojet, USA; Neill, Todd, Aerojet, USA; Yam, Clement, Aerojet, USA; 1999; In English; Joint Propulsion, 20-23 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics
Contract(s)/Grant(s): NAS8-40891; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In the past two years Strutjet Rocket Based Combined Cycle (RBCC) engine has been tested extensively under the Advanced Reusable Technology (ART) contract from NASA MSFC. RBCC Engines combine the high thrust to weight of the rocket with the high efficiency of the ramjet engine. This propulsion system has the potential to reduce the cost of launching payloads to orbit by up to a factor of 100. In the ART program we have conducted over 100 hot fire tests. The propellants have been hydrogen and oxygen. The Modes tested have included the Air Augmented Rocket (AAR) from M = 0 to 2.4, the Ramjet at M = 2.4 & 6, Scramjet at M = 6 & 8, Scram/Rocket at Mach 8 and Ascent Rocket in Vacuum. This invited paper will present an overview of these test results and plans for future development of this propulsion cycle.
Author
Supersonic Combustion Ramjet Engines; Performance Tests; High Thrust; Payloads; Thrust Augmentation

19990102883 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
Structural Analysis in Designing the RX-250 Rocket Nozzle *Pengembangan Metoda Untuk Menganalisis Struktur Nozel Roket RX-250*
Triharjanto, Robertus Heru, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Ginting, Salam, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; January 1999; ISSN 0126-0480; Volume 1, No. 1, pp. 21-30; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The structural analysis in designing the RX-250 rocket nozzle is a significant process in minimizing the weight of the rocket. This paper discussed the process in determining the dimension of the RX-250 rocket nozzle. The structural calculation used the input from aerothermodynamic characteristic of the nozzle, that was the pressure and temperature inside the nozzle. New methods were used on the aerothermodynamics system of the nozzle and the strength of material calculation, which define the safety factor desired at the beginning of the calculation. These methods successfully reduce the weight of the nozzle by 40%.
Author
Structural Analysis; Rocket Nozzles; Nozzle Design; Structural Design

19990102948 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
Analysis of Temperature and Pressure Distribution on RX-250 Rocket Motor Housing Walls *Analisis Distribusi Temperatur Dan Tegangan Pada Dinding Tabung Motor Roket RX-250*
Ediwan, Ganda Samosir, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July 1998; ISSN 0126-0480; Volume 22, No. 86, pp. 1-7; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Static test for motor rocket RX-250 was conducted at Static Test Laboratory of LAPAN Rumpin in order to measure the amount of thrust measured by the motor rocket. During the test, it was observed that the motor rocket cylinder failed at internal pressure of 120 atmosphere at the fourth second of supposed six-second-long burning time. While according to the theoretical analysis result, the maximum allowable internal pressure for this motor rocket tube was 130 atmosphere. The motor rocket tube was 2 m long with wall thickness of 1 cm and cap thickness of 1.1 cm. This paper analysis the cause of motor rocket tube failure. The analysis is emphasised on the effect of excessive thermal stress on one area due to imperfection of propellant connection such that the ignition fire has reached the wall of the motor rocket earlier than expected. The thermal analysis used the result from previous research on the material properties of Al alloy used in the current motor rocket at different temperatures.
Author
Pressure Distribution; Temperature Distribution; Walls; Rocket Engines; Housings

19990103080 NASA Marshall Space Flight Center, Huntsville, AL USA

Inertial-Electrostatic Confinement (IEC) Fusion For Space Propulsion

Nadler, Jon, Illinois Univ., USA; [1999]; 7p; In English, Aug. 1999, Huntsville, AL, USA; Sponsored by NASA, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

An Inertial-Electrostatic Confinement (IEC) device was assembled at the Marshall Space Flight Center (MSFC) Propulsion Research Center (PRC) to study the possibility of using IEC technology for deep space propulsion and power. Inertial-Electrostatic Confinement is capable of containing a nuclear fusion plasma in a series of virtual potential wells. These wells would substantially increase plasma confinement, possibly leading towards a high-gain, breakthrough fusion device. A one-foot in diameter IEC vessel was borrowed from the Fusion Studies Laboratory at the University of Illinois @ Urbana-Champaign for the summer. This device was used in initial parameterization studies in order to design a larger, actively cooled device for permanent use at the PRC.

Author

Inertial Confinement Fusion; Electrostatics; Propulsion

19990103147 NASA Marshall Space Flight Center, Huntsville, AL USA

Development of a Low Cost Data Acquisition System for the Solid Rocket Booster Program

Crawford, Kevin, NASA Marshall Space Flight Center, USA; Pinkleton, David, Boeing North America, Inc., USA; Jun. 24, 1998; 1p; In English; Digital Avionics SC, 31 Oct. - 6 Nov. 1998, Seattle, WA, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Space Transportation System's (STS) Solid Rocket Boosters (SRBs) experience a severe environment during their brief flight. During the last few years several SRB's have sustained noticeable structural damage. The environmental characteristics (vibration, structure, and thermal) encountered by the SRB's during ascent, descent and water impact are in most cases unknown. A developmental flight instrumentation (DFI) system collected data from the SRB's first four flights in the early 1980's, and after the first three flights during the shuttle return-to-flight phase after the Challenger accident. However, the DFI data collected are of low fidelity and do not correlate well with the observed structural damage. The DFI system was evaluated for reuse, but the cost to fly it was prohibitive. The STS is presently scheduled to fly until 2030. To support the STS schedule the avionics on SRB's will be upgraded. The environments on the different sections of the SRB will need to be defined to properly qualify the avionics for multiple flights. The DFI data previously gathered does not provide enough information to properly qualify the avionics. Marshall Space Flight Centers (MSFC) SRB Project Office requested the Science and Engineering Directorate to develop a self contained data acquisition system that could collect data from any area of the booster. This paper summarizes the effort to develop, test, qualify and fly an Enhanced Data Acquisition System (EDAS) using state-of-the-art commercial off the shelf (COTS) equipment. The first flight of this system occurred on shuttle mission STS-91 in June 1998.

Author

Data Acquisition; Space Shuttle Boosters; Product Development

19990103353 Air Force Academy, CO USA

Polyethylene and Hydrogen Peroxide Hybrid Testing at the USA Air Force Academy *Final Report, 2 Aug. 1997 - 20 May 1998*

Bettner, Michael; Humble, Ronald W.; Aug. 10, 1998; 11p; In English
Report No.(s): AD-A367246; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The USA Air Force Academy (USAFA) has been conducting propulsion research over the past several years and has recently been focusing on hydrogen peroxide applications. A hybrid motor configuration using hydrogen peroxide as the oxidizer and polyethylene as the fuel was first tested at USAFA in the spring of 1996. While the propellants have not changed since the first test firing, significant advancements have been made in catalyst design, ignition, nozzles, and thrust levels. Three static tests and one sounding rocket flight were accomplished during the spring semester 1998 at USAFA. The static test goals were: (1) Demonstrate autoignition of single and multiple port motors; (2) Examine methods for reducing ignition time; (3) Characterize fuel regression; (4) Gather data on flux rates through the catalyst material and fuel port; (5) Characterize and validate performance accurately through simulation; and (6) Develop sufficient thrust for a sounding rocket.

DTIC

Polyethylenes; Hydrogen Peroxide; Propulsion System Configurations; Hybrid Rocket Engines

19990103941 NASA Marshall Space Flight Center, Huntsville, AL USA

Development of a 12-Thrust Chamber Kerosene /Oxygen Primary Rocket Sub-System for an Early (1964) Air-Augmented Rocket Ground-Test System

Pryor, D., NASA Marshall Space Flight Center, USA; Hyde, E. H., NASA Marshall Space Flight Center, USA; Escher, W. J. D., Science Applications International Corp., USA; 1999; 1p; In English; 16th, Nov. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Report No.(s): AIAA Paper 99-4896; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Airbreathing/Rocket combined-cycle, and specifically rocket-based combined- cycle (RBCC), propulsion systems, typically employ an internal engine flow-path installed primary rocket subsystem. to achieve acceptably short mixing lengths in effecting the "air augmentation" process, a large rocket-exhaust/air interfacial mixing surface is needed. This leads, in some engine design concepts, to a "cluster" of small rocket units, suitably arrayed in the flowpath. to support an early (1964) subscale ground-test of a specific RBCC concept, such a 12-rocket cluster was developed by NASA's Marshall Space Flight Center (MSFC). The small primary rockets used in the cluster assembly were modified versions of an existing small kerosene/oxygen water-cooled rocket engine unit routinely tested at MSFC. Following individual thrust-chamber tests and overall subsystem qualification testing, the cluster assembly was installed at the U. S. Air Force's Arnold Engineering Development Center (AEDC) for RBCC systems testing. (The results of the special air-augmented rocket testing are not covered here.) While this project was eventually successfully completed, a number of hardware integration problems were met, leading to catastrophic thrust chamber failures. The principal "lessons learned" in conducting this early primary rocket subsystem experimental effort are documented here as a basic knowledge-base contribution for the benefit of today's RBCC research and development community.
Author

Product Development; Performance Tests; Air Breathing Engines; Propulsion System Performance; Ground Tests; Engine Design

19990104063 NASA Marshall Space Flight Center, Huntsville, AL USA

Elimination of High-Frequency Combustion Instability in the Fastrac Engine Thrust Chamber

Rocker, Marvin, NASA Marshall Space Flight Center, USA; Nesman, Tomas E., NASA Marshall Space Flight Center, USA; 1999; 8p; In English, 18-22 Oct. 1999, Cocoa Beach, FL, USA; Sponsored by Department of the Army, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A series of tests were conducted to stabilize the combustion of the Fastrac engine thrust chamber. The first few stability tests resulted in unstable combustion due ineffective acoustic cavity designs. The thrust chamber exhibited unstable combustion in the first-tangential mode and its harmonics. Combustion was stabilized by increasing the volume of the acoustic cavities and by plugging the dump-cooling orifices so that the cavities were uncooled. Although the first few stability tests resulted in unstable combustion, prior and subsequent long-duration performance tests of the Fastrac thrust chamber were spontaneously stable. Stability considerations during the injector faceplate design were based on the Hewitt correlation.
Author

Stability Tests; Combustion Stability; Thrust Chambers; Performance Tests

19990104275 NASA Lewis Research Center, Cleveland, OH USA

Method and Apparatus for Pressure Pulse Arcjet Starting

Sankovic, John M., Inventor, NASA Lewis Research Center, USA; Curran, Francis M., Inventor, NASA Lewis Research Center, USA; Aug. 10, 1999; In English; Division of US-Patent-Appl-SN-626742, filed 26 Mar. 1996, which is division of US-Patent-Appl-SN-236855, filed 2 May 1994

Patent Info.: Filed 5 Aug. 1997; NASA-Case-LEW-15665-3; US-Patent-5,934,068; US-Patent-Appl-SN-906550; US-Patent-Appl-SN-626742; US-Patent-Appl-SN-236855; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

The invention disclosed is directed to a method and apparatus for an arcjet starter. The invention discloses a method of moving an arc from the subsonic region of the thruster to the supersonic region by introducing a pressurized propellant into the casuty of the anode.
Author

Pressure Pulses; Jet Propulsion; Arc Jet Engines; Ion Engines; Electric Propulsion

19990105699 NASA Marshall Space Flight Center, Huntsville, AL USA

Ongoing Analysis of Rocket Based Combined Cycle Engines by the Applied Fluid Dynamics Analysis Group at Marshall Space Flight Center

Ruf, Joseph, NASA Marshall Space Flight Center, USA; Holt, James B., NASA Marshall Space Flight Center, USA; Canabal,

Francisco, NASA Marshall Space Flight Center, USA; Sep. 13, 1999; 1p; In English; 10th; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper presents the status of analyses on three Rocket Based Combined Cycle configurations underway in the Applied Fluid Dynamics Analysis Group (TD64). TD64 is performing computational fluid dynamics analysis on a Penn State RBCC test rig, the proposed Draco axisymmetric RBCC engine and the Trailblazer engine. The intent of the analysis on the Penn State test rig is to benchmark the Finite Difference Navier Stokes code for ejector mode fluid dynamics. The Draco engine analysis is a trade study to determine the ejector mode performance as a function of three engine design variables. The Trailblazer analysis is to evaluate the nozzle performance in scramjet mode. Results to date of each analysis are presented.
Author
Design Analysis; Engine Design; Fluid Dynamics; Rocket-Based Combined-Cycle Engines; Supersonic Combustion Ramjet Engines

19990105709 NASA Marshall Space Flight Center, Huntsville, AL USA
Fastrac Gas Generator Testing
Nesman, Tomas E., NASA Marshall Space Flight Center, USA; Dennis, Jay, NASA Marshall Space Flight Center, USA; 1999; 2p; In English; 10th; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA; Original contains color illustrations
Contract(s)/Grant(s): RTOP 242-34-ZT; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A rocket engine gas generator component development test was recently conducted at the Marshall Space Flight Center. This gas generator was intended to power a rocket engine turbopump by the combustion of Lox and RP-1. The testing demonstrated design requirements for start sequence, wall compatibility, performance, and stable combustion. During testing the gas generator injector was modified to improve distribution of outer wall coolant and the igniter boss was modified to investigate the use of a pyrotechnic igniter, Expected chamber pressure oscillations at longitudinal acoustic modes were measured for three different chamber lengths tested. High amplitude discrete oscillations occurred in the chamber-alone configurations when chamber acoustic modes coupled with feed-system acoustics modes. For the full gas generator configuration, which included the turbine inlet manifold simulator, high amplitude oscillations occurred only at off-design very low power levels. This testing led to a successful gas generator design for the Fastrac 60,000 lb thrust engine.
Author
Performance Tests; Rocket Engines; Gas Generators; Combustion; Feed Systems; Intake Systems

23
CHEMISTRY AND MATERIALS (GENERAL)

19990100603 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA
Characterization of the (beta)-phase of the palladium-hydrogen equation of state
Fisher, K. J.; Jul. 31, 1998; 92p; In English
Report No.(s): DE98-007270; LA-13460-T; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The (beta)-phase of the P-C-T curves of the palladium-hydrogen system is encountered at high pressures of gaseous hydrogen and low temperatures of this system. The (beta)-phase is characterized by an increase in the concentration of hydrogen in the palladium lattice with an increase in pressure of the free hydrogen gas surrounding the palladium. The P-C-T curves in this study are determined by gravimetric measurements of the hydrided palladium sample to determine the amount of hydrogen within the palladium lattice. The amount of hydrogen is kept constant within the experimental system and the temperature is varied which changes the pressures. The objective of this experimental thesis is to accurately determine the P-C-T curves of palladium in the (beta)-phase region to pressures of 20,000 psia and medium to low temperature region of (minus)60 C to 100 C.
NTIS
Palladium; Phase Diagrams; Hydrogen; Equations of State

19990100972 National Renewable Energy Lab., Golden, CO USA
Surface Analytical Study of CuInSe2 Treated in Cd-Containing Partial Electrolyte Solution
Niles, D.W., National Renewable Energy Lab., USA; Nov. 19, 1998; 379p; In English; National Center for Photovoltaics Program Review Meeting, 8-11 Sep. 1998, Denver, CO, USA
Report No.(s): DE00-005062; NREL/CP-520-25757; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Junction formation in CuInSe2 (CIS) has been studied by exposing thin films and single-crystal samples to solutions containing NH4OH and CdSO4. The treated samples were analyzed by secondary ion mass spectrometry to determine the amount and

distribution of Cd deposited on the surface of the films. Cadmium is found to react with the surface for all the solution exposure times and temperatures studied. The reaction rapidly approaches the endpoint and remains relatively unchanged for subsequent solution exposure. Cadmium in-diffusion, as measured by secondary ion mass spectrometry, is obscured by topography effects in the thin-film samples and by ion-beam mixing and topography in the single- crystal sample.

NTIS

Copper Selenides; Indium Compounds; Secondary Ion Mass Spectrometry; Single Crystals; Thin Films

19990104382 National Renewable Energy Lab., Golden, CO USA

NICE3 SO3 Cleaning Process in Semiconductor Manufacturing

Blazek, Steve, National Renewable Energy Lab., USA; Jan. 29, 1999; 379p; In English

Report No.(s): DE00-004092; NREL/FS-330-25027; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

This fact sheet explains how Anon, Inc., has developed a novel method of removing photoresist--a light-sensitive material used to produce semiconductor wafers for computers--from the computer manufacturing process at reduced cost and greater efficiency. The new technology is technically superior to existing semiconductor cleaning methods and results in reduced use of hazardous chemicals.

NTIS

Cleaning; Semiconductors (Materials); Sulfur Oxides; Wafers

19990104385 National Renewable Energy Lab., Golden, CO USA

Aluminum: Aluminum Scrap Decoater

Blazek, Steve, National Renewable Energy Lab., USA; Jan. 29, 1999; 379p; In English

Report No.(s): DE00-003799; NREL/FS-330-26056; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

NICE3 and the Philip Services Corporation are cost-sharing a demonstration project to decoat metal using indirect-fired controlled-atmosphere (IDEX) kilns, which can both process solid organics such as rubber and plastics, and minimze dust formation and emission of volatile organic compounds. The publication explains how this cost-effective, two-step system operates.

NTIS

Aluminum; Chemical Cleaning; Stripping; Coatings

19990105729 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Mass Spectral Data of Trimethylsilyl Esters of Alkyl and Cycloalkyl Methylphous *Final Report*

Wils, E. R. J., Prins Maurits Lab. TNO, Netherlands; deJong, A. L., Prins Maurits Lab. TNO, Netherlands; vanBaar, B. L. M., Prins Maurits Lab. TNO, Netherlands; May 1999; 56p; In English

Contract(s)/Grant(s): A93/KL/424; TNO Proj. 014.11024

Report No.(s): TD99-0101; PML-1999-A6; Copyright; Avail: Issuing Activity, Hardcopy

The development of a procedure for the recording of reference mass spectra of trimethylsilyl (TMS) esters of alkyl and cycloalkyl methylphosphonates is described. The compounds are prepared in situ, on a small scale, from methylphosphonic difluoride and a selected alcohol dissolved in acetonitrile. Hydrolysis of the formed alkyl and cycloalkyl methylphosphonofluoridates to the corresponding methylphosphonates, evaporation to dryness and trimethylsilylation of the residue produces the TMS esters. The resultant reaction mixture is analysed by gas chromatography-mass spectrometry. In this way, electron impact mass spectra of TMS esters of 17 alkyl (ranging from butyl to nonyl) methylphosphonates and five cycloalkyl methylphosphonates were recorded. The mass spectra and a short description of the fragmentation processes of the TMS esters are presented.

Author

Procedures; Technology Assessment; Mass Spectra; Hydrolysis; Gas Chromatography; Emission Spectra; Alkyl Compounds

Includes physical, chemical, and mechanical properties of laminates and other composite materials. For ceramic materials see 27 Nonmetallic Materials.

19990099729 NASA Marshall Space Flight Center, Huntsville, AL USA
Potential Applications and Properties of Alumina/Aluminum MMC at Cryogenic Temperatures
Lee, Jonathan A., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 23rd; COmposites, Materials and Structures, 25-29 Jan. 1999, Cocoa Beach, FL, USA
Contract(s)/Grant(s): RTOP 242-33-00; No Copyright; Avail: Issuing Activity, Hardcopy

Efforts were under way at NASA-Marshall Space Flight Center (MSFC) to determine the potential applications of lightweight aluminum Metal Matrix Composite (MMC) for rocket propulsion hardwares such as the turbopump housing and rotating turbomachinery. The goal was to reduce the weight of advanced liquid hydrogen and oxygen rocket engines by using materials with very high specific strengths at cryogenic temperatures. A feasibility study was conducted for alumina continuous fibers reinforced with aluminum MMC to be used for the high speed turbopump's impeller. Several technical issues specific to MMC's were addressed, including the anisotropic MMC properties at cryogenic temperatures and rotating machinery design methodology.
Author
Aluminum; Aluminum Oxides; Cryogenic Temperature; Metal Matrix Composites; Matrix Materials; Mechanical Properties; Thermophysical Properties

19990100627 Los Alamos National Lab., NM USA
Bounds on the strength distribution of unidirectional fiber composites
Mahesh, S.; Phoenix, S. L.; Beyerlein, I. J.; Dec. 31, 1999; 6p; In English; Engineering Mechanics; Sponsored by American Society of Civil Engineers
Report No.(s): DE99-002725; LA-UR-99-963; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Failure mechanisms under tensile loading of unidirectional fiber composites comprising of Weibull fibers embedded in a matrix are studied using Monte-Carlo simulations. Two fundamental mechanisms of failure are recognized--stress concentration driven failure and strength driven failure. It is shown that the cumulative distribution function for composite strength predicted by the stress concentration-driven failure and strength-driven failure form apparent upper and lower bounds respectively and also that failure mechanism switches from one to the other as fiber strength variability changes.
NTIS
Fiber Strength; Fiber Composites; Distribution Functions; Composite Materials

19990102897 Los Alamos National Lab., NM USA
Texture and residual strain in SiC/Ti-6-2-4-2 titanium matrix composites
Rangaswamy, P.; Bourke, M. A. M.; Von Dreele, R.; Bennett, K.; Roberts, J. A.; Dec. 31, 1998; 30p; In English; 1998 Minerals, Metals and Materials Society (TMS) fall meeting
Report No.(s): DE99-002268; LA-UR-98-3185; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Residual strain and texture variations were measured in two Titanium matrix composites reinforced with Silicon Carbide fibers (Ti/SiC) of similar composition but fabricated by different processing routes. Each composite comprised a Ti-6242 (alpha)/(beta) matrix alloy containing 35% by volume continuous SiC fibers. In one composite, the matrix was produced by a plasma spray (PS) route, and in the other by a wire drawing (WD) process. The PS and WD composites were reinforced with SCS-6 (SiC) and Trimarc (SiC) fibers, respectively. The texture in the titanium matrices differed significantly, from approximately (approx) 1.1x random for the monolithic and composite produced by PS route to (approx) 17x random in the monolithic and (approx)6x random in the composite produced by the WD route. No significant differences in matrix residual strains between the composites prepared by the two procedures were noted. The Trimarc (WD) fibers recorded higher ((approx)1.3x) compressive strains than the SCS-6 (PS) fibers in all the measured directions. The plane- specific elastic moduli, measured in load tests on the un-reinforced matrices, showed little difference.
NTIS
Textures; Silicon Carbides; Titanium; Metal Matrix Composites; Residual Stress

19990103065 National Aerospace Lab., Structures Div., Tokyo, Japan

Technical Report of National Aerospace Laboratory. Evaluation of Fatigue Crack Growth Characteristics of a Fiber/ Metal Laminate GLARE3-5/4

Takamatsu, T.; Matsumura, T.; Ogura, N.; Shimokawa, T.; Kakuta, Y.; Oct. 1999; 22p; In Japanese; Original contains color illustrations

Report No.(s): PB99-169609; NAL-TR-1366; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

The objective of this study is to investigate the properties of fatigue crack growth in a GLARE3-5/4 fiber/metal laminate and the validity of methods for analyzing the fatigue crack growth of fiber/metal laminates. GLARE3-5/4 consists of five thin sheets of 2024-T3 aluminum alloy and four layers of (0/90) glass/epoxy. Centrally notched specimens were fatigue tested under constant amplitude loading and crack length was measured using the DC potential-drop method. The size of the delamination produced between aluminum alloy sheets and fiber-adhesive layers was measured from C-scan pictures taken around a fatigue crack.
NTIS

Fatigue (Materials); Crack Propagation; Laminates; Fatigue Tests; Glass Fiber Reinforced Plastics

19990104355 Notre Dame Univ., Dept. of Aerospace and Mechanical Engineering, IN USA

Application of Dynamic Fracture Mechanics Concepts to Composites *Annual Report, 1 Jun. 1998 - 31 May 1999*

Mason, J. J.; Jun. 1999; 167p; In English

Contract(s)/Grant(s): N00014-96-0774

Report No.(s): AD-A364906; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

The report is divided into five chapters covering new analytical solutions for dynamic cracks in orthotropic composites. Each chapter stands alone and has been submitted, accepted or prepared for publication in a refereed journal. First, closed form solutions for uniformly loaded semi-infinite cracks in orthotropic materials are presented. Next, solutions regarding the stress intensity factor at the tip of propagating cracks in orthotropic materials are presented. In addition, closed form, dynamic Green's functions solutions are given for semi-infinite cracks in orthotropic materials. Previously, in last year's report, numerical Green's function solutions were presented for this case the first time. These newer, closed form solutions are much easier to produce and implement in more complex solutions. The problem of having a crack in transversely isotropic material rotated with respect to the crack front is also solved with some effort. The methodology used in finding all these solutions may be used in other problems including penetration mechanics. Such applications are currently being explored. Finally, experimental investigation of the application of these solutions to dynamic crack initiation in composites under impact conditions is being completed.
DTIC

Crack Propagation; Fracture Mechanics; Fiber Composites; Stress Intensity Factors

19990104368 Rutherford Appleton Lab., Chilton, UK

An Ordered Stack of Spin Valves in a Layered Magnetoresistive Perovskite

Perring, T. G., Rutherford Appleton Lab., UK; Aeppli, G., NEC Research Inst., USA; Kimura, T., Joint Research Center for Atom Technology, Japan; Tokura, Y., Joint Research Center for Atom Technology, Japan; Adams, M. A., Rutherford Appleton Lab., UK; Nov. 25, 1998; 1p; In English

Report No.(s): RAL-TR-1998-074; Copyright; Avail: Issuing Activity (CLRC, Rutherford Appleton Lab., Chilton, Didcot, Oxfordshire, OX11 0QX, UK), Hardcopy, Microfiche

This paper is a study on the ordered stacks of spin valves in a layered magnetoresistive perovskite. Neutron diffraction data was used to show that the magnetic structure of the layered compound La(2-2x)SR(1+2x)Mn2O7 (x=0.3) which consists of metallic MnO2 sheets separated by insulating material switches from antiferromagnetic stacking of the (ferromagnetically ordered) sheets in zero field to ferromagnetic stacking in a field of 1.5 Tesla.
CASI

Magnetoresistivity; Antiferromagnetism; Valves; Perovskites; Neutron Diffraction; Ferromagnetism

19990104381 National Renewable Energy Lab., Golden, CO USA

Glass: Producing Glass Fiber

Recca, Lee, National Renewable Energy Lab., USA; Jan. 29, 1999; 379p; In English

Report No.(s): DE00-004133; NREL/FS-330-25189; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

As detailed in the fact sheet, this new glass fiber-producing process can yield fibers that are more uniform in diameter, break less easily, and be produced more economically.
NTIS

Glass Fibers; Fiber Composites; Fabrication; Mechanical Properties

19990105813 ManTech Environmental Technology, Inc., Dayton, OH USA
Preliminary Analysis of Off-Gassing Following Thermal Stress of Advanced Composite Materials *Interim Report*
Meyer, Gary D.; Lipscomb, John C.; Courson, David L.; Aug. 1998; 22p; In English
Contract(s)/Grant(s): F41624-96-C-9010; AF Proj. 7757
Report No.(s): AD-A367418; AFRL-HE-WP-TR-1998-0083; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Advanced composite material (ACM) use in the military and private sectors is increasing. Previous work identified the release of toxic compounds during combustion of ACM. However, the question of off-gassing following heat stress had not been addressed. This preliminary study looked at the semivolatile compounds off-gassed from four different types of ACM following thermal stress of 625 deg C. Daily samples of the off-gassed semivolatiles were collected by Tenax TAO tubes and by cold trapping. The ACM samples were still off-gassing at the end of the 15-16 day sampling period. Results with the four targeted compounds (aniline, phenol, quinoline, and naphthalene) and the semivolatile compounds tentatively identified by ion match were too varied to prudently extrapolate the identity and/or quantity released of any specific compounds associated with another type of ACM. However, it can be deduced that only well-ventilated areas should be used for thermally stressed ACM to prevent the build-up of off-gassed materials to dangerous levels. In addition, the study results fully support the continued use of the personal protective equipment guidelines presented in paragraph 34,e,(3) of TO 00-105E-9, Aircraft Emergency Response. These results underscore the need to examine the specific ACM in question and address the issues associated with that ACM. Further research is recommended to fully characterize ACM off-gassing following thermal stress.
DTIC
Toxicity; Composite Materials; Combustion; Thermal Stresses

25
INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry. For related information see also 77 Thermodynamics and Statistical Physics.

19990101418 National Renewable Energy Lab., Golden, CO USA
Investigation of Deep Levels in GaInNAs
Balcioglu, A., National Renewable Energy Lab., USA; Friedman, D., National Renewable Energy Lab., USA; Abulfotuh, F., National Renewable Energy Lab., USA; Geisz, J., National Renewable Energy Lab., USA; Kurtz, S., National Renewable Energy Lab., USA; Nov. 12, 1998; 9p; In English; National Center for Photovoltaics Program Review Meeting, 8-11 Sep. 1998, Denver, CO, USA
Report No.(s): DE00-006698; NREL/CP-520-25785; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

This paper presents and discusses the first Deep-Level transient spectroscopy (DLTS) data obtained from measurements carried out on both Schottky barriers and homojunction devices of GaInNAs. The effect of N and In doping on the electrical properties of the GaNInAs devices, which results in structural defects and interface states, has been investigated. Moreover, the location and densities of deep levels related to the presence of N, In, and N+In are identified and correlated with the device performance. The data confirmed that the presence of N alone creates a high density of shallow hole traps related to the N atom and structural defects in the device. Doping by In, if present alone, also creates low-density deep traps (related to the In atom and structural defects) and extremely deep interface states. On the other hand, the co-presence of In and N eliminates both the interface states and levels related to structural defects. However, the device still has a high density of the shallow and deep traps that are responsible for the photocurrent loss in the GaNInAs device, together with the possible short diffusion length.
NTIS
Gallium Arsenides; Indium Compounds; Spectroscopic Analysis; Schottky Diodes; Nitrogen Compounds

19990101419 National Renewable Energy Lab., Golden, CO USA
Surface Science in an MOCVD Environment: Arsenic on Vicinal Ge(100)
Olsen, J. M., National Renewable Energy Lab., USA; McMahon, W. E., National Renewable Energy Lab., USA; Nov. 01, 1998; 8p; In English; National Center for Photovoltaics Program Review Meeting, 8-11 Sep. 1998, Denver, CO, USA
Report No.(s): DE00-006696; NREL/CP-520-25747; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Scanning tunneling microscope (STM) images of arsine-exposed vicinal Ge(100) surfaces show that most As/Ge steps are reconstructed, and that a variety of different step structures exist. The entire family of reconstructed As/Ge steps can be divided into two types, which we have chosen to call 'single-row' steps and 'double-row' steps. In this paper we propose a model for a

double-row step created by annealing a vicinal Ge(100) substrate under an arsine flux in a metal-organic chemical vapor deposition (MOCVD) chamber.
NTIS
Metalorganic Chemical Vapor Deposition; Arsenic; Surface Properties; Germanium; Microstructure

19990101861 National Renewable Energy Lab., Golden, CO USA
Spectroscopic Analysis of Impurity Precipitates in CdS Films
Oct. 31, 1999; 379p; In English; National Center for Photovoltaics Program Review Meeting, 8-11 Sep. 2999, Denver, CO, USA
Report No.(s): DE00-005027; NREL/CP-520-25287; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Impurities in cadmium sulfide (CdS) films are a concern in the fabrication of copper (indium, gallium) diselenide (CIGS) and cadmium telluride (CdTe) photovoltaic devices. Devices incorporating chemical-bath-deposited (CBD) CdS are comparable in quality to devices incorporating purer CdS films grown using vacuum deposition techniques, despite the higher impurity concentrations typically observed in the CBD CdS films. In this paper, we summarize and review the results of Fourier transform infrared (FTIR), Auger, electron microprobe, and X-ray photoelectron spectroscopic (XPS) analyses of the impurities in CBD CdS films. We show that these impurities differ as a function of substrate type and film deposition conditions. We also show that some of these impurities exist as 10(sup 2) micron-scale precipitates.
NTIS
Impurities; Cadmium Sulfides; Fabrication; Solar Cells; Spectroscopic Analysis; Photoelectron Spectroscopy; Semiconducting Films

19990102410 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermal/Pyrolysis Gas Flow analysis of MX4926 Carbon Phenolic Material Tested at the Laser Hardened Material Evaluation Laboratory
Clayton, J. Louie, NASA Marshall Space Flight Center, USA; Nov. 24, 1997; In English; Nondestructive Evaluation Subcommittee Rocket Nozzle Technology Subcommittee, 16-20 Mar. 1998, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Provided in this study are theoretical predictions for in-depth temperature and pressure distributions in the MX4926 carbon phenolic materials tested at the Laser Hardened Material Evaluation Laboratory (LHMEL). Governing equations, numerical techniques and comparisons to measured temperature data are also presented. High heat rate kinetics were used for in-depth decomposition simulation. Surface thermochemical conditions were determined using the Aerotherm Chemical Equilibrium (ACE) program. Surface heating simulation used pre-test measured, facility calibrated radiative and convective flux levels, Temperatures and pressures are predicted using an upgraded form of the SINDA/CMA program which was developed during the Solid Propulsion Integrity Program (SPIP). Multi-specie mass balance, tracking of condensable vapors, real gas compressibility and reduced mixture viscosity's have been added to the algorithm. In general, surface and in-depth temperature comparisons are very good. Specie partial pressures calculations show that saturated water-vapor mixture is the main contributor to peak in-depth total pressure. Further, for most of the cases studied, the water-vapor mixture is driven near the critical point for this substance and is believed to briefly but significantly increase the local heat capacity of the composite material. This phenomena, if not accounted for in analysis models, may lead to an over prediction in temperature response in the charring region.
Author
Thermal Analysis; Pyrolysis; Gas Flow; Laser Materials; Heat Transmission; Thermochemistry

19990102622 NASA Marshall Space Flight Center, Huntsville, AL USA
Elimination of High-Frequency Combustion Instability in the Fastrac Engine Thrust Chamber
Rocker, Marvin, NASA Marshall Space Flight Center, USA; Nesman, Tomas E., NASA Marshall Space Flight Center, USA; Apr. 19, 1999; 1p; In English, 18-22 Oct. 1999, Cocoa Beach, FL, USA; Sponsored by Department of the Army; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A series of tests were conducted to stabilize the combustion of the Fastrac engine thrust chamber. The first few stability tests resulted in unstable combustion due ineffective acoustic cavity designs. The thrust chamber exhibited unstable combustion in the first-tangential mode and its harmonics. Combustion was stabilized by increasing the volume of the acoustic cavities and by plugging the dump-cooling orifices so that the cavities were uncooled. Although the first few stability tests resulted in unstable combustion, prior and subsequent long-duration performance tests of the Fastrac thrust chamber were spontaneously stable. Stability considerations during the injector faceplate design were based on the Hewitt correlation.
Author
Thrust Chambers; High Frequencies; Combustion Stability; Stability Tests

19990102895 Ames Lab., IA USA

Single- and multi-photon ionization studies of organosulfur species

Cheung, Y. S.; Feb. 12, 1999; 51p; In English

Report No.(s): DE99-002516; IS-T-1863; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Accurate ionization energies (IE's) for molecular species are used for prediction of chemical reactivity and are of fundamental importance to chemists. The IE of a gaseous molecule can be determined routinely in a photoionization or a photoelectron experiment. IE determinations made in conventional photoionization and photoelectron studies have uncertainties in the range of 3--100 meV (25--250 cm(exp -1)). In the past decade, the most exciting development in the field of photoionization and photoelectron spectroscopy has been the availability of high resolution, tunable ultraviolet (UV) and vacuum ultraviolet (VUV) laser sources. The laser pulsed field ionization photoelectron (PFI-PE) scheme is currently the state-of-the-art photoelectron spectroscopic technique and is capable of providing photoelectron energy resolution close to the optical resolution. The author has focused attention on the photoionization processes of some sulfur-containing species. The studies of the photoionization and photodissociation on sulfur-containing compounds (such as CS2, CH3SH, CH3SSCH3, CH3 CH2SCH2CH3, HSCH2CH2SH and C4H4S (thiophene) and sulfur-containing radicals, such as HS, CS, CH3, CH3CH2S and CH3SS), have been the major subjects in the group because sulfur is an important species contributing to air pollution in the atmosphere. The modeling of the combustion and oxidation of sulfur compounds represents important steps for the control of both the production and the elimination of sulfur-containing pollutants. Chapter 1 is a general introduction of the thesis. Chapters 2 and 6 contain five papers published in, or accepted for publication in, academic periodicals. In Chapter 7, the progress of the construction in the laboratory of a new vacuum ultraviolet laser system equipped with a reflectron mass spectrometer is presented. Chapters 2 through 7 have been removed for separate processing. A general conclusion of these studies are given in Chapter 8 followed by an appendix.

NTIS

Photoionization; Organic Sulfur Compounds

19990102901 NASA Marshall Space Flight Center, Huntsville, AL USA

Leonid's Particle Analyses from Stratospheric Balloon Collection on Xerogel Surfaces

Noever, David, NASA Marshall Space Flight Center, USA; Phillips, Tony, NASA Marshall Space Flight Center, USA; Horack, John, NASA Marshall Space Flight Center, USA; Porter, Linda, NASA Marshall Space Flight Center, USA; Myszka, Ed, NASA Marshall Space Flight Center, USA; 1999; In English; Leonids Meteor, 12 Apr. 1999, Santa Clara, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recovered from a stratospheric balloon above 20 km on 17-18 November 1998, at least eight candidate microparticles were collected and analyzed from low-density silica xerogel collection plates. Capture time at Leonids' storm peak was validated locally along the balloon trajectory by direct video imaging of meteor fluence up to 24/hr above 98% of the Earth's atmosphere. At least one 30 micron particle agrees morphologically to a smooth, unmelted spherule and compares most closely in non-volatile elemental ratios (Mg/Si, Al/Si, and Fe/Si) to compositional data in surface/ocean meteorite collections. A Euclidean tree diagram based on composition makes a most probable identification as a non-porous stratospherically collected particle and a least probable identification as terrestrial matter or an ordinary chondrite. If of extraterrestrial origin, the mineralogical class would be consistent with a stony (S) type of silicate, olivine [(Mg,Fe)2SiO4] and pyroxene [(Mg, Fe)Si!O3)--or oxides, herecynite [(Fe,Mg) Al2O4].

Author

Meteorites; Meteoroids; Microparticles; Stratosphere; Chemical Composition

19990102926 Albert (Karen Keppler), Zurich, Switzerland

Determination of Spectral Line Parameters in Selected Portions of the Infrared Spectrum of Water Vapor *Final Report*

Albert, Karen Keppler, Albert (Karen Keppler), Switzerland; [1999]; 17p; In English

Contract(s)/Grant(s): NAG1-2084; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Pressure broadening and pressure-induced shift coefficients due to water and nitrogen have been determined for water vapor transitions in the CO2 region of interest to Project HALOE. The temperature dependences of the widths and shifts have also been determined for selected transitions in this region. Results have been compared with values available in the literature. The line parameters have been obtained from the analysis of room temperature recordings of the spectrum of pure water and recordings of the spectra of heated water/nitrogen mixtures. The recordings of the water vapor spectrum were obtained with Fourier Transform Spectrometers at Kitt Peak and at the Justus-Liebig-Universitat Giessen. Up to eighteen spectra have been fitted simultaneously with a multispectrum nonlinear least-squares fitting technique developed by Dr. D. Chris Benner and colleagues.

Author

Spectral Line Width; Infrared Spectra; Water Vapor; Carbon Dioxide; Temperature Dependence

19990102973 Cranfield Univ., Dept. of Automotive, Combustion and Energy Engineering, Bedford, UK

Planar Measurements of Fuel Vapour, Liquid Fuel, liquid Droplet Size and Soot

Greenhalgh, Douglas A., Cranfield Univ., UK; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 7-1 - 7-18; In English; See also 19990102970; Original contains color illustrations

Contract(s)/Grant(s): CEC-AER2-CT92-0036; EPSRC-GR/H78238; EPSRC-GR/K37215; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The design of combustors requires high combustion efficiency with both low NO(x) and low soot emissions coupled to reliable ignition and good weak stability. Fuel placement resulting from fuel injection is critical to all these factors. In most combustors the fuel enters as a liquid and its subsequently evaporated and burn. Diagnostics, which can readily map the patternation of liquid and vapour phases of fuel, are therefore of immense practical value to the combustor engineer. In addition the performance of the atoml'ser can be assessed through the resulting droplet size. This paper introduces and describes two laser sheet imaging methods for the measurement of fuel in its liquid and vapour phases (LIF or Laser Induced Fluorescence and LSD or Laser Sheet dropsizing) and a method for imaging soot, namely LII or laser Induced Incandescence.
Author

Diagnosis; Drop Size; Imaging Techniques; Soot; Nitrogen Oxides; Vapor Phases; Ignition

19990102992 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Generation and Filtration Behaviour of Test Aerosols with Various Shapes *Final Report*

Tuinman, I. L., Prins Maurits Lab. TNO, Netherlands; June 1999; 46p; In English; Original contains color illustrations

Contract(s)/Grant(s): C97/BAS/614; TNO Proj. 014.10033

Report No.(s): TD99-0105; PML-199-B10; Copyright; Avail: Issuing Activity, Hardcopy

Aerosols encountered in reality often differ with respect to shape and size from test aerosols used to certify filters. For this reason a study has been performed to produce test aerosols of various shapes in order to investigate the influence of particle shape on the penetration through some fibrous filters.With a Condensation Monodisperse Aerosol Generator, aerosols of several shapes besides the standard spherical oil-particles were produced: 1) rod-shaped caffeine particles; 2) angular urea particles; 3) plate-like eico-sanoic acid particles. The particle size distribution as a function of the temperature of the compound under production was determined with a DMA for particles smaller than 0.7 microns and for particles larger than 0.5 microns also with an APS (TSI 3320). The penetration of these aerosols through different particle filters was compared with the penetration of standard oil aerosols (Durasyn 164) with an equivalent particle size distribution. The penetration generally reduces from spherical particles via needles and rods to a lowest penetration for plates. The plate-shaped eico-sanoic acid crystals and, to a lesser extent, the caffeine rods, form an extra filter layer with a high pressure drop on top of the filter cloth. Preliminary experiments indicate that electret filters have a higher efficiency for bacteria spores than for physical aerosols. Considering the current problems with biological aerosols in, for example, hospitals and the military, this requires additional research.
Author

Research; Aerosols; Particle Size Distribution; Crystals; Filtration

19990102998 Environmental Protection Agency, Washington, DC USA

EPA/ITRC-RTDF Permeable Reactive Barrier Short Course. Permeable Reactive Barriers: Application and Deployment

1999; 242p; In English

Report No.(s): PB99-164808; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

Contents included are: Permeable Reactive Barriers - Application and Deployment; Introduction to Permeable Reactive Barriers (PRBs) for Remediating and Managing Contaminated Groundwater in Situ; Collection and Interpretation of Design Data I - Site Characterization for PRBs; Reactive Materials - Zero-Valent Iron; Collection and Interpretation of Design Data II - Laboratory and Pilot Scale Tests; Design Calculations; Compliance Monitoring, Performance Monitoring and Long-Term Maintenance for PRBs; PRB Emplacement Techniques; PRB Permitting and Implementation; Treatment of Metals; Non-Metallic Reactive Materials; Economic Considerations for PRB Deployment; and Bibliography.
NTIS

Ground Water; Water Pollution; Pollution Monitoring; Pollution Transport; Pollution Control; Water Treatment

19990103071 Rutherford Appleton Lab., Chilton UK

TOSCA 1 User-Guide

Parker, S. F.; Champion, D. J.; Tomkinson, J.; Colognesi, D.; Aug. 20, 1999; 70p

Report No.(s): PB99-168791; RAL-TR-1999-060; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

Contents include the following: Introduction; Recording A Spectrum; Controlling the Instrument; Data Analysis and Visualization; The Hardware on TOSCA; The Vital Staff; and Appendices.
NTIS
Inelastic Scattering; Nuclear Scattering; Neutron Scattering; Nuclear Particles; Neutron Spectrometers

19990103124 Rhode Island Dept. of Transportation, Research Technology Development Div., Providence, RI USA
Quantitative Studies of Chloride Permeability of Concrete *Final Report, Jun. 1996 - Jul. 1998*
Walsh, J.; Sock, M.; Lima, J.; Quintin, S.; Fera, J.; Dec. 1998; 74p; In English; Portions of this document are not fully legible
Report No.(s): PB99-167421; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
Studies were undertaken to develop a quantitative determination of chloride ion permeability in concrete based upon measuring the chloride ion migration in the concrete. The intent was to modify AASHTO standard method T-277 to measure the amount of chloride ion which completely passed through a concrete specimen while simultaneously measuring total charge as normally performed by the method. Studies showed that more than 99% of the chloride ion does not pass completely through the concrete disk specimen, but instead, remains within the concrete disk. Evaluation of permeability by measurement of complete passage of chloride ion was therefore not feasible. However, measurement of the test cell chloride ion transferred into the concrete disk was found to be a means to evaluate chloride permeability of the concrete specimen. This enables the measurement of chloride ion permeability in grams of chloride rather than in columbus of total charge. The studies showed that total charge as measured in the T-277 method is not due solely to chloride ion, but that the total charge is an accumulation of charges contributed to by a water electrolysis background charge, and charges due to presence of other ions in the test cell solutions. It was shown that based upon the amount of chloride ion transferred into the concrete disk, the total charge measured was always much greater than that possibly due to chloride ion alone. Based upon these findings, total charge is not a specific measure of chloride ion permeability. Measurement of chloride ion transferred into the concrete specimen appears to be a direct evaluation of chloride ion permeability of the concrete. It is actually a measure of the absorbance of chloride ion by concrete, and specifically defines the amount (by weight) of chloride ion taken-up by, or permeating into a concrete specimen.
NTIS
Chlorides; Electrolysis; Ions; Permeability

19990103163 NASA Marshall Space Flight Center, Huntsville, AL USA
Noble Metal Immersion Spectroscopy of Silica Alcogels and Aerogels
Smith, David D., NASA Marshall Space Flight Center, USA; Sibille, Laurent, Universities Space Research Association, USA; Cronise, Raymond J., NASA Marshall Space Flight Center, USA; Noever, David A., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
We have fabricated aerogels containing gold and silver nanoparticles for gas catalysis applications. by applying the concept of an average or effective dielectric constant to the heterogeneous interlayer surrounding each particle, we extend the technique of immersion spectroscopy to porous or heterogeneous media. Specifically, we apply the predominant effective medium theories for the determination of the average fractional composition of each component in this inhomogeneous layer. Hence, the surface area of metal available for catalytic gas reaction is determined. The technique is satisfactory for statistically random metal particle distributions but needs further modification for aggregated or surfactant modified systems. Additionally, the kinetics suggest that collective particle interactions in coagulated clusters are perturbed during silica gelation resulting in a change in the aggregate geometry.
Author
Noble Metals; Spectroscopy; Silicon Dioxide; Aerogels; Fabrication; Gold; Silver; Technology Transfer; Submerging

19990103354 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
A Technique for Determining Thermal Transport Properties of Small, Electrically Conductive Liquid or Solid Specimens *Final Report, May - Oct. 1998*
McQuaid, Micahel; Cohen, Max; Mar. 1999; 47p; In English
Contract(s)/Grant(s): Proj-1L161102AH43
Report No.(s): AD-A367243; ARL-TR-1905; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
The experimental approach developed by Miller and Kotlar for determining the thermal conductivity and thermal diffusivity of small, solid, energetic-material specimens-"Technique for Measuring the Thermal Diffusivity/Conductivity of Small Thermal Insulator Specimens," Review of Scientific Instruments, vol. 64, pp. 2954-2960, 1993-has been modified and extended for use in determining these properties for electrically conductive materials, including liquids. As in the technique developed by Miller and Kotlar, these properties are determined from the transient temperature response of a point in an experimental system consisting

of two "semi-infinite" media, a plane of which is subjected to a well-defined heat flux. However, to allow the technique to be employed with electrically conductive specimens, the experiment is configured so that the heat flux is generated at a plane in a nonconductive solid (as opposed to the interface between the media), and the temperature response is measured in this solid as well. The parameter (lambda) pc(sub p))(sup 1/2) is obtained by fitting a numerical simulation of the heat transfer process to the temperature response. Coupling the model to a nonlinear least-squares fitting routine facilitates this effort. to obtain absolute values for the specimen's thermal conductivity and thermal diffusivity, knowledge of its density and heat capacity is required. The viability of the experimental approach was established through experiments with water, methanol, and ethylene glycol, and the technique was employed to obtain the thermal conductivity of liquid propellant XM46 for temperatures in the range 20-60 C.
DTIC
Thermal Conductivity; Electrical Resistivity; Thermal Diffusivity; Conducting Fluids; Heat Transfer

19990103620 Naval Research Lab., Bay Saint Louis, MS USA
Spatial and Temporal Relationships Between Localized Corrosion and Bacterial Activity on Iron-Containing Substrata
Franklin, M.; Little, B. J.; Ray, R. I.; Jun. 1999; 5p; In English
Contract(s)/Grant(s): Proj-3103
Report No.(s): AD-A367315; NRL/PP/7303--99-0032; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
    A series of laboratory and field experiments were designed to determine the temporal and spatial relationships between accumulations of bacteria and pitting corrosion of iron-containing metals exposed in fresh and marine electrolytes. Abiotic corrosion was established in both carbon and stainless steels prior to the introduction of viable and glutaraldehyde-fixed bacteria in fresh water and seawater media. In all cases a spatial relationship between accumulations of cells and localized corrosion was documented. regardless of the origin of the localized corrosion. Both viable and glutaraldehyde-fixed cells were preferentially attracted to anodic regions on iron substrata and cells were enmeshed in iron corrosion products. The attraction, specific for iron, was more influential than topography in determining the spatial distribution of bacterial cells. Results indicate that spatial relationships cannot be interpreted as causal. i.e., accumulations of bacterial cells in iron corrosion products cannot be simply interpreted as microbiologically influenced corrosion.
DTIC
Bacteria; Corrosion; Iron; Anodic Coatings; Microorganisms

19990105692 Naval Research Lab., Washington, DC USA
VLF Nitrogen Purge System *Interim Report*
Lamontagne, Robert A.; Aug. 20, 1999; 22p; In English
Report No.(s): AD-A367320; NRL/MR/6116--99-8393; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    This report summarizes the installation of Nitrogen Purge Systems and the accompanying dissolved oxygen sensor systems at the four water cooled very low frequency radio transmitting sites. These four sites differ in their physical plant and transmitting capabilities. to accommodate these differences, the size and configuration of the Nitrogen Purge Systems and Oxygen Sensing Systems are slightly different. The systems are composed of off-the-shelf items to allow for ease of maintenance and repair.
DTIC
Nitrogen; Purging; Oxygen Supply Equipment; Very Low Frequencies; Radio Transmitters

19990105693 Applied Research Associates, Inc., Panama City, FL USA
Operational Implementation of Ammonium Perchlorate Biodegradation *Final Report, Jul. 1997 - Jun. 1998*
Coppola, Edward N.; Rine, Jeffrey; Startzell, Greg; Jun. 19, 1998; 63p; In English
Contract(s)/Grant(s): F08637-98-C-6002
Report No.(s): AD-A367321; AFRL-ML-TY-TR-1999-4524; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy
    This technology is a low-cost biodegradation process that converts the perchlorate ion (ClO4-) in process wastewater to chloride (CL-). Perchlorate can be reduced from a concentration greater than 1.0% to a concentration below detection limits (is less than 0.5 ppm). Effluents from this process can be discharged directly to conventional sewage treatment facilities. This process will: (1) Reduce environmental liability to DoD and its contractors by reducing the generation of hazardous wastes; (2) Minimize adverse impact of environmental compliance to DoD support operations; (3) Reduce cost for solid rocket propellant and large rocket motor disposal; (4) Facilitate component, propellant, and propellant ingredient recovery and reuse; and (5) Enable the continued use of AP, a critical defense material, in propulsion systems for the DoD. The objective of this demonstration was to provide a production-scale, operational validation of the ammonium perchlorate (AP) biodegradation process that was developed by the

Air Force Research Laboratory. Components of an existing pilot-scale demonstration unit were modified and integrated into existing waste treatment facilities at Thiokol's production plant near Brigham City, Utah.
DTIC
Ammonium Perchlorates; Biodegradation; Sewage Treatment

19990105715 Norwegian Defence Research Establishment, Kjeller, Norway
Methyl Salicylate, Sulphur Mustard and Dipropyleneglycol Methyl Ether Analyzed by Headspace Gas Chromatography
Metylsalisylat, Sennepsgass og Dipropylengy Ykolmetyleter Analysert med Headspace Gasskromatografi
Endregard, Monica, Norwegian Defence Research Establishment, Norway; Watterud, Geir, Norwegian Defence Research Establishment, Norway; Busmundrud, Odd, Norwegian Defence Research Establishment, Norway; Sep. 02, 1999; 24p; In Dutch
Contract(s)/Grant(s): Proj. FFIBM/757/138
Report No.(s): FFI/RAPPORT-99/04231; ISBN 82-464-0368-0; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    Vapour concentrations curves have been measured by Headspace Gas Chromatography (HS-GC) for methyl salicylate (MS), dipropyleneglycol methyl ether (DPM) and sulphur mustard (HD). Previous studies at FFI have encountered calibration problems for MS. The conclusion from the present work is that Al-coated silicon rubber septa have to be used when analysing the above mentioned compounds instead of teflon-coated buthyl rubber septa. Using the latter type of septa introduce a significant source of error, most likely due to diffusion through the teflon part of the septum to the buthyl rubber part. The calibration problem was not observed for analyses of ethanol and nonane.
Author
Methyl Compounds; Salicylates; Ethers; Vapors; Concentration (Composition)

19990105809 Naval Research Lab., Washington, DC USA
Propellant Fires in a Simulated Shipboard Compartments: Project HULVUL, Phase 3 *Final Report*
Williams, F. W.; Back, G. G.; Darwin, R. L.; Scheffey, J. L.; Aug. 20, 1999; 42p; In English
Report No.(s): AD-A367293; NRL/MR/6180-99-8394; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    A multi-phase investigation was conducted to quantify the thermal insult produced by the burning of unspent solid rocket propellant in a missile hit scenario. The objectives of this multi-phase investigation were to; identify the thermal conditions produced in the compartment during the missile fuel burning stage, identify the likelihood for ignition of Class A materials in the space and bound the transition time for the ensuring compartment fire. This report summarizes the results of the third and final phase of this investigation.
DTIC
Antiship Missiles; Guidance (Motion); Missile Control; Warheads

19990105812 ManTech Environmental Technology, Inc., Dayton, OH USA
Stability and Concentration Verification of Ammonium Perchlorate Dosing Solutions *Interim Report, Aug. 1997 - Jan. 1998*
Tsui, David T.; Mattie, David R.; Narayanan, Latha; May 1998; 38p; In English
Contract(s)/Grant(s): F41624-96-C-9010; AF Proj. 7757
Report No.(s): AD-A367416; AFRL-HE-WP-TR-1998-0068; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    Stability and concentration verification was performed for the ammonium perchlorate dosing solutions used in the on-going 90-Day Oral Toxicity Study conducted by Springborn Laboratories, Inc. (SLI Study No. 3433.1) and the Neurobehavioral Development study conducted by Argus Research Laboratories, Inc. (SS No. 7757A2l0-1096-25F). A sensitive and selective ion chromatography (IC) method for the analysis of perchlorate (ClO_4^-) and nitrate (NO_3^-), a possible interference anion, was developed to support these studies. The method development, and validation data more than sufficiently demonstrated that the IC method was capable of detecting both perchlorate and nitrate at 0.003 microgram/mL (5 ppb) in reagent water with excellent accuracy and precision. Ion chromatographic analysis of the stability solutions showed that under controlled room temperature, relative humidity and light intensity, ammonium perchlorate was stable in reagent water for at least 109 days. The concentrations of the ammonium perchlorate dosing solutions (0.05 to 200 micrograms/mL) were verified by IC analysis to be within an acceptable range of +/- 10%.
DTIC
Toxicity; Ammonium Perchlorates; Chromatography; Stability; Sensitivity

19990106258 AeroChem Research Labs., Inc., Princeton, NJ USA

Interaction of Burning Metal Particles *Final Report, 1 Jul. 1996 - 31 Aug. 1999*

Dreizin, Edward L., AeroChem Research Labs., Inc., USA; Berman, Charles H., AeroChem Research Labs., Inc., USA; Hoffmann, Vern K., AeroChem Research Labs., Inc., USA; Aug. 31, 1999; 90p; In English

Contract(s)/Grant(s): NAS3-96017

Report No.(s): TP-579; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Physical characteristics of the combustion of metal particle groups have been addressed in this research. The combustion behavior and interaction effects of multiple metal particles has been studied using a microgravity environment, which presents a unique opportunity to create an "aerosol" consisting of relatively large particles, i.e., 50-300 micrometer diameter. Combustion behavior of such an aerosol could be examined using methods adopted from well-developed single particle combustion research. The experiment included fluidizing relatively large (order of 100 micrometer diameter) uniform metal particles under microgravity and igniting such an "aerosol" using a hot wire igniter. The flame propagation and details of individual particle combustion and particle interaction have been studied using a high speed movie and video-imaging with cameras coupled with microscope lenses to resolve individual particles. Interference filters were used to separate characteristic metal and metal oxide radiation bands form the thermal black body radiation. Recorded flame images were digitized and employed to understand the processes occurring in the burning aerosol. The development of individual particle flames, merging or separation, and extinguishing as well as induced particle motion have been analyzed to identify the mechanisms governing these processes. Size distribution, morphology, and elemental compositions of combustion products were characterized and used to link the observed in this project aerosol combustion phenomena with the recently expanded mechanism of single metal particle combustion.

Author

Metal Particles; Microgravity; Aerosols; Combustion Products; Particle Motion; Flame Propagation; Metal Combustion

26
METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

19990100669 Department of Energy, Office of Energy Research, Washington, DC USA

Experimental investigations of the Sneddon solution and an improved solution for the analysis of nanoindentation data

Hay, J. C.; Pharr, G. M.; Dec. 31, 1998; 7p; In English; Sponsored by American Chemical Society, USA

Report No.(s): DE99-000375; ORNL/CP-98988; CONF-980402; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The Sneddon solution, as it is implemented in the Oliver-Pharr method, deviates from the indentation experimental data in a manner which depends on both the indenter angle and the Poisson ratio of the sample. These effects are demonstrated experimentally by performing indentations in tungsten and aluminum using a cube-cube corner indenter where the effect are exacerbated by the small indenter angle. The first objective was to experimentally support and validate an approximate analytical solution in conjunction with finite element simulations which illustrate the Poisson ratio and indenter angle effects. Second, a review of data analysis procedures is presented which leads to a better understanding of the systematic errors which percolate through in the measurement of Young's modulus and hardness.

NTIS

Indentation; Data Processing

19990100970 National Renewable Energy Lab., Golden, CO USA

Inventions & Innovations: Products from Metal Powders

Poole, Lauren, National Renewable Energy Lab., USA; Recca, Lee, National Renewable Energy Lab., USA; Jan. 14, 1999; 379p; In English

Report No.(s): DE00-005831; NREL/FS-330-25303; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The latest innovative process for heat treating metal powders can both reduce costs and save energy is discussed.

NTIS

Metal Powder; Powder Metallurgy; Heat Treatment

19990101421 National Renewable Energy Lab., Golden, CO USA

Motor Challenge: Improving Efficiency of Tube Drawing Bench Reduces Energy Use by 34%

Ericksen, Erika, National Renewable Energy Lab., USA; Jan. 25, 1999; 379p; In English

The case study reveals how a manufacturer of high-precision, small-diameter steel tubing has reduced energy consumption and realized considerable electrical, labor, and materials cost savings with a more energy-efficient motor.
NTIS
Stainless Steels; Pipes (Tubes)

19990101875 Alabama Univ., Center for Microgravity and Materials Research, Huntsville, AL USA

Analysis of Residual Acceleration Effects on Transport and Segregation During Directional Solidification of Tin-Bismuth in the MEPHISTO Furnace Facility *Final Report, Mar. 1995 - Mar. 1998*

Alexander, J. Iwan D., Alabama Univ., USA; 1998; 8p; In English

The research accomplishments summarized in this Final Report during the period from 3/95 to 3/98, which included a 12 months no-cost extension granted at the end of the nominal 2 year period of performance. The report has 5 sections, in section 1 the objectives are presented, a task description is given and the background and significance of the work is outlined. In section 2 the research accomplishments are summarized. In section 3 publications and presentations are listed. Student participation is listed in 4. The work is summarized in section 5. and references for sections 1 and 2 are supplied in section 6. The object of this work, is to approach the problem of determining the transport conditions (and effects of residual acceleration) during the plane-front directional solidification of a tin-bismuth alloy under low gravity conditions. The work involved using a combination of 2- and 3-D numerical models, scaling analyses, ID models and the results of ground-based and low-gravity experiments. The experiments conducted in the MEPHISTO furnace facility during the USW-3 space flight which took place between February 22 through March 6, 199). This experiment represents an unprecedented opportunity to make a quantitative correlation between residual accelerations and the response of an actual experimental solidification
Author
Tin Alloys; Bismuth; Microgravity; Directional Solidification (Crystals)

19990102218 NASA Marshall Space Flight Center, Huntsville, AL USA

Liquidus Temperatures and Solidification Behavior in the Copper-Niobium System

Li, D., National Academy of Sciences - National Research Council, USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Rathz, T. J., Alabama Univ., USA; Williams, G., Alabama Univ., USA; [1998]; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The copper-niobium phase diagram has been under active debate; thus, a corroboratory experimental study is needed. In this investigation, the melts of Cu-Nb alloys at compositions ranging from 5 to 86 wt pct Nb were processed in different environments and solidified at relatively low cooling rates of 50 to 75 C/s to determine liquidus temperatures and to study solidification behavior. For all samples processed under very clean conditions, only Nb dendrites in a Cu matrix were observed; while in the presence of oxygen impurities the alloys containing 5 to 35 wt pct Nb exhibited microstructure of Nb-rich spheroids and Nb dendrites in the Cu matrix. The results obtained from clean conditions are in fair agreement with the Cu-Nb phase diagram having an S-shaped, near-horizontal appearance of the liquidus. The formation of Nb- rich droplets at slow cooling rates is discussed in terms of a stable liquid miscibility gap induced by oxygen.
Author
Liquidus; Temperature Dependence; Solidification; Copper; Niobium; Phase Diagrams

19990102219 NASA Marshall Space Flight Center, Huntsville, AL USA

On the Cu-Nb Phase Diagram and Solidified Microstructures

Li, D., National Academy of Sciences - National Research Council, USA; Robinson, M. B., NASA Marshall Space Flight Center, USA; Rathz, T. J., Alabama Univ., USA; Williams, G., Alabama Univ., USA; [1998]; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Container and containerless processing was employed to determine liquidus temperatures and to examine microstructural development in the Cu-Nb system. The Cu-Nb phase diagram of an S-shaped, near-horizontal liquidus, has been confirmed by both the temperature-time profiles and resultant microstructures with only Nb dendrites in a Cu matrix, which were obtained from crucible experiments under clean conditions. However, the microstructural pathways of Cu-Nb alloys are particularly sensitive to processing variables. by the addition of oxygen impurities or rapid solidification, droplet-shaped morphology was observed

for some compositions, implying occurrence of a liquid-phase separation. The effects of impurities and cooling rates are analyzed in connection with a stable and metastable liquid miscibility gap, respectively.
Author
Microstructure; Solidification; Copper Alloys; Niobium Alloys; Temperature Profiles; Liquidus; Phase Diagrams

19990102222 NASA Marshall Space Flight Center, Huntsville, AL USA
3-D Modeling of Directional Solidification of a Non-Dilute Alloy with Temperature and Concentration Fields Coupling via Materials Properties Dependence and via Double Diffusive Convection
Bune, Andris V., NASA Marshall Space Flight Center, USA; Gillies, Donald C., NASA Marshall Space Flight Center, USA; Lehoczky, Sandor L., NASA Marshall Space Flight Center, USA; 1998; In English, 13 Apr. 1998, San Francisco, CA, USA; Sponsored by Materials Research Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Numerical simulation of the HgCdTe growth by the vertical Bridgman method was performed using FIDAP finite element code. Double-diffusive melt convection is analyzed, as the primary factor at controls inhomogeneity of the solidified material. Temperature and concentration fields in the model are also coupled via material properties, such as thermal and solutal expansion coefficients with the dependence on both temperature and concentration, and melting temperature evaluation from pseudobinary CdTe-HgTe phase diagram. Experimental measurements were used to obtain temperature boundary conditions. Parametric study of the melt convection dependence on the gravity conditions was undertaken. It was found, that the maximum convection velocity in the melt can be reduced under certain conditions. Optimal conditions to obtain a near flat solidified interface are discussed. The predicted interface shape is in agreement with one obtained experimentally by quenching. The results of 3-D calculations are compared with previous 2- D findings. A video film featuring 3-D melt convection will be presented.
Author
Three Dimensional Models; Numerical Analysis; Directional Solidification (Crystals); Mercury Cadmium Tellurides; Melts (Crystal Growth)

19990102869 NASA Marshall Space Flight Center, Huntsville, AL USA
Effect of a Nonplanar Melt-Solid Interface on Lateral Compositional Distribution during Unidirectional Solidification of a Binary Alloy with a Constant Growth Velocity V, Part 1, Theory
Wang, Jai–Ching, NASA Marshall Space Flight Center, USA; Watring, Dale A., NASA Marshall Space Flight Center, USA; Lehoczky, Sandor L., NASA Marshall Space Flight Center, USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Gillies, Don, NASA Marshall Space Flight Center, USA; Szofran, Frank, NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Optical Science, 19 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Infrared detector materials, such as Hg(1-x)Cd(x)Te, Hg(1-x)Zn(x)Te have energy gaps almost linearly proportional to its composition. Due to the wide separation of liquidus and solidus curves of their phase diagram, there are compositional segregations in both of axial and radial directions of these crystals grown in the Bridgman system unidirectionally with constant growth rate. It is important to understand the mechanisms which affect lateral segregation such that large uniform radial composition crystal is possible. Following Coriell, etc's treatment, we have developed a theory to study the effect of a curved melt-solid interface shape on the lateral composition distribution. The system is considered to be cylindrical system with azimuthal symmetric with a curved melt-solid interface shape which can be expressed as a linear combination of a series of Bessell's functions. The results show that melt-solid interface shape has a dominate effect on lateral composition distribution of these systems. For small values of b, the solute concentration at the melt-solid interface scales linearly with interface shape with a proportional constant of the product of b and $(1 - k)$, where $b = VR/D$, with V as growth velocity, R as sample radius, D as diffusion constant and k as distribution constant. A detailed theory will be presented. A computer code has been developed and simulations have been performed and compared with experimental results. These will be published in another paper.
Author
Melts (Crystal Growth); Planar Structures; Liquid-Solid Interfaces; Binary Alloys; Velocity; Solidification; Mercury Cadmium Tellurides

19990103023 NASA Marshall Space Flight Center, Huntsville, AL USA
Measurement of Interfacial Undercooling in a Dilute Pb-Sn Alloy Near the Regime of Morphological Instability
Sen, S., Universities Space Research Association, USA; Dhindaw, B. K., Indian Inst. of Tech., India; Peters, P., NASA Marshall Space Flight Center, USA; Curreri, P., NASA Marshall Space Flight Center, USA; Kaukler, W. F., Alabama Univ., USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The solid/liquid (s/1) interfacial Seebeck technique was used to measure interfacial undercooling in a Pb-1 wt.% Sn alloy. For plane front solidification an undercooling in the range of 0.54-0.57C was recorded. However, for growth velocities between 6 to 15 micron/s the undercooling, increased with increase in velocity. 'Tbis is in contradiction to the theoretical predictions based on growth at the extremum condition. A modified analytical expression was developed based on the maro,,inal stability criterion to predict undercooling for growth velocities immediately over the limit of morphological stability. Between 6 to 15 microns/s the trend predicted by this modified expression is in qualitative agreement with the experimental results. This model is more consistent with the analysis of Venugopal and Kirkaldy which states that the extremum condition criterion is not applicable in the marginal stability regime. At higher growth velocities between 20 and 50 microns/s where stable cellular growth is expected the undercooling, decreased with increase in velocity. The predictions of Burden and Hunt based on extremum criterion agree reasonably well with the experimental results in this velocity range. Finally, the importance of non-equilibrium phase diagram parameters such as partition coefficient and liquidus slope were also evaluated using the experimental undercooling results obtained in this investigation.

Author

Extremum Values; Morphology; Solidification; Stability; Supercooling

19990103053 Sandia National Labs., Albuquerque, NM USA

Ordering of Self-Diffusion Barrier Energies on Pt(110)-1x2; Physical Review B, Radio Communications

Feibelman, P. J., Sandia National Labs., USA; Jun. 01, 1999; 17p; In English

Report No.(s): DE00-007226; SAND99-1369J; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Bond-counting arguments, supported by ab-initio calculations, predict a lower barrier for 'leapfrog' diffusion of Pt addimers on Pt(110)-lx2 than for adatom diffusion or addimer dissociation. This conflicts with experiment, possibly signaling contaminant influence.

NTIS

Diffusion; Platinum; Dissociation; Surface Properties

19990103055 Sandia National Labs., Albuquerque, NM USA

Description of a Furnace for the Creation of Anisotropic Porous Metals

Gutsch, T., Sandia National Labs., USA; Miszkiel, M., Sandia National Labs., USA; Schmale, D. T., Sandia National Labs., USA; May 01, 1999; 22p; In English

Report No.(s): DE00-007223; SAND99-1031; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

A furnace has been built for the purpose of producing anisotropic porous metals through solid-gas eutectic solidification. This process allows control of continuously formed anisotropic pores in metals and was discovered at the State Metallurgical Academic' University in Dnepropetrovsk Ukraine. The process incorporates hydrogen gas within the metal as it solidifies from the molten state. Metals which do not form hydrides, including iron, nickel, aluminum, copper and others can be formed in this manner. The furnace is housed within an ASME code stamped cylindrical stainless steel vacuum/pressure vessel. The vessel is a water chilled vertical cylinder with removable covers at the top and bottom. It can be evacuated to 20 mTorr or pressurized to 5.5 MPa (800 psi). A charge of 2700 cc of molten metal can be melted in a crucible in the upper portion within a watercooled 30 cm (12 in.) ID induction coil. A 175 kW Inductotherm power source energizes the coil. Vertical actuation of a ceramic stopper rod allows the molten metal to be tapped into a solidification mold beneath the melting crucible. The cylindrical mold rests on a water cooled copper base inducing directional solidification from the bottom. Mixtures of hydrogen and argon gases are introduced during the process. The system is remotely controlled and located in a structure with frangible walls specially designed for possible ambient pressure excursions as a result of equipment failure. This paper includes a general description of the furnace and operating procedure and a detailed description of the control, monitoring and interlock systems.

NTIS

Furnaces; Porous Materials; Directional Solidification (Crystals); Eutectics

19990103062 National Renewable Energy Lab., Golden, CO USA

Identifying Electronic Properties Relevant to Improving Stability in a- Si:H-Based Cells and Overall Performance in a-Si,Ge:H-Based Cells *Final Report, 18 Apr. 1994 - 15 Jan. 1998*

Cohen, J. D., National Renewable Energy Lab., USA; Nov. 16, 1998; 68p; In English

Report No.(s): DE00-006699; NREL/SR-520-25802; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The work carried out by the University of Oregon Under this subcontract focused on the characterization and evaluation of low-gap (a-Si,Ge:H) alloy materials and on issues related to overall stability in the mid-gap (a-SiH) materials. First, researchers characterized an extensive series of Uni-Solar a- Si,Ge:H samples using drive-level capacitance profiling and the analysis of sub-

band-gap photocapacitance and photocurrent spectra. Thus, several bands of deep defect transitions were identified. Researchers were able to verify that charged defects are responsible for the different observed defect bands in device-quality a-Si,Ge:H alloy material. Second, they reported results of their measurements on a-Si,Ge:H alloy 'cathodic' samples produced at Harvard University; these samples were found to exhibit significantly lower defect densities in the high Ge composition range (greater than 50 at.% Ge) than alloy samples produced either by conventional glow discharge of photo-chemical vapor deposition. Third, they performed voltage pulse stimulated capacitance transient measurements on a-Si:H/a-Si,Ge:H heterostructure samples to look for carrier trapping states that might be associated with this interface; they found there was a clear signature of trapped hole emission extending over long times associated specifically with the interface itself in concentrations of roughly 10(exp 11) cm(exp -2). Fourth, researchers reported the results on several hot-wire a-Si:H samples produced with varying hydrogen levels. Their studies indicate that hot-wire-produced a-Si:H, with H levels between 2-5at.%, should lead to mid-gap devices with superior properties. Finally, they discussed some results on glow-discharge material, as well electron-cyclotron- resonance-deposited a-Si:H grown under hydrogen dilution conditions, and confirmed that, in terms of deep-defect creation, such films exhibited improved stability compared to conventional glow-discharge material.
NTIS

Thin Films; Vapor Deposition; Amorphous Silicon; Heterojunctions; Electrical Properties; Stability; Hydrogen

19990103102 NASA Marshall Space Flight Center, Huntsville, AL USA

Determination of the Solid/Liquid Interface Shape and Resultant Radial Homogeneity in Directionally Solidified Hg(0.89)Mn(0.11)Te

Price, M. W., Corning, Inc., USA; Scripa, R. N., Alabama Univ., USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Szofran, F. R., NASA Marshall Space Flight Center, USA; Hanson, B., Corning, Inc., USA; 1999; In English; 11th; Association for Crystal Growth and Epitaxy (ACCGE), 31 Jul. - 1 Aug. 1999, Tucson, AZ, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Directional solidification and interrupted directional solidification experiments were used to determine tile shape of the solid/liquid interface and the resultant radial homogeneity in Hg(0.89)Mg(0.11)Te. For directionally solidified samples solidified at a rate of 0.09 microns/sec in a thermal gradient of 83 C/cm, a maximum of 0.006 molar percent MnTe radial variation across the Hg0.89)Mn(0.11)Te boules at specific locations was determined using an FTIR technique. This FTIR evaluation of the radial homogeneity also indicated an asymmetrical, convex interface shape during solidification. The asymmetrical, convex shape of the growth interface was confirmed by interrupted directional solidification experiments. These were performed under the same growth conditions as the normally completed directional solidification experiments except that the samples were quenched before the final growth transient was reached. In these experiments, etching and scanning X-ray fluorescence were used to reveal the shape of the solid/liquid interface. Microprobe analysis of composition gradients across the interface was used to confirm the authors' previous work in evaluating the segregation coefficient of Hg(0.89)Mn(0.11)Te alloy. Microprobe analysis of the interface region of the interrupted growth sample revealed a dendritic structure containing secondary and tertiary dendritic arms.
Author

Liquid-Solid Interfaces; Homogeneity; Shapes; Position (Location); Directional Solidification (Crystals); Crystal Structure

19990103106 NASA Marshall Space Flight Center, Huntsville, AL USA

Interaction of Porosity with an Advancing Solid/Liquid Interface: a Real-Time Investigation

Sen, S., Universities Space Research Association, USA; Kaukler, W., NASA Marshall Space Flight Center, USA; Catalina, A., NASA Marshall Space Flight Center, USA; Stefanescu, D., NASA Marshall Space Flight Center, USA; Curreri, P., NASA Marshall Space Flight Center, USA; 1999; In English; 4th; Modeling of Casting and Solid, Processes, 5 Sep. 1999, Seoul, Korea, Republic of

Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Problems associated with formation of porosity during solidification continue to have a daily impact on the metal forming industry. Several past investigations have dealt with the nucleation and growth aspects of porosity. However, investigations related to the interaction of porosity with that of a solidification front has been limited mostly to organic analogues. In this paper we report on real time experimental observations of such interactions in metal alloys. Using a state of the art X-Ray Transmission Microscope (XTM) we have been able to observe and record the dynamics of the interaction. This includes distortion of the solid/liquid interface near a poro.sity, solute segr,egation patterns surrounding a porosity and the change in shape of the porosity during interaction with an advancing solid/liquid interface. Results will be presented for different Al alloys and growth conditions. The experimental data will be compared to theory using a recently developed 2D numerical model. The model employs a finite difference approach where the solid/liquid interface is defined through the points at which the interface intersects the grid lines. The transport variables are calculated at these points and the motion of the solidification front is determined by the magnitude of the transport

variables. The model accounts for the interplay of the thermal and solutal field and the influence of capilarity to predict the shape of the solid/liquid interface with time in the vicinity of porosity. One can further calculate the perturbation of the solutal field by the presence of porosity in the melt.

Author

Porosity; Liquid-Solid Interfaces; Real Time Operation; Solidification; Data Acquisition; Numerical Analysis

19990103158 NASA Marshall Space Flight Center, Huntsville, AL USA

Undercooling, Liquid Separation and Solidification of Cu-Co Alloys

Robinson, M. B., NASA Marshall Space Flight Center, USA; Li, D., NASA Marshall Space Flight Center, USA; Rathz, J., National Academy of Sciences - National Research Council, USA; Williams, G., National Academy of Sciences - National Research Council, USA; [1998]; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Large undercooling can induce not only various solidification pathways, but also a precursor reaction, or liquid separation. This paper deals with the latter effect of undercooling using examples of the Cu-Co system which has a flattened liquidus. Bulk Cu-Co alloys (about 7mm diameter) at compositions ranging from 10 to 90 wt pct Co were highly undercooled using a fluxing technique. Except for Cu-90 wt pct Co, liquid separation was directly observed as undercooling exceeded a critical value depending on the composition. It was also confirmed by a microstructural transition from dendrites to droplets above the critical undercooling. Finally, theoretical calculations regarding the metastable miscibility boundary and maximum droplet radius were made to analyze the experimental results.

Author

Supercooling; Liquidus; Solidification; Copper Compounds; Cobalt Compounds; Chemical Fractionation

19990103164 NASA Marshall Space Flight Center, Huntsville, AL USA

Effect of Percolation on the Cubic Susceptibility of Metal Nanoparticle Composites

Smith, David D., NASA Marshall Space Flight Center, USA; Bender, Matthew W., NASA Marshall Space Flight Center, USA; Boyd, Robert W., Rochester Univ., USA; 1998; 1p; In English; Nonlinear Optics 1998, 10-14 Aug. 1998, Kauai, HI, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Generalized two-dimensional and three-dimensional Maxwell Garnett and Bruggeman geometries reveal that a sign reversal in the cubic susceptibility occurs for metal nanoparticle composites near the percolation threshold.

Author

Two Dimensional Models; Three Dimensional Models; Percolation

19990103367 Brookhaven National Lab., Materials Science Div., Upton, NY USA

Magnetization reversal in melt-quenched NdFeB

Crew, D. C.; Lewis, L. H.; McCormick, P. G.; Street, R.; Panchanathan, V.; Dec. 31, 1999; 6p; In English; Sponsored by Material Research Society

Report No.(s): DE99-002665; BNL-66051; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Melt-quenched NdFeB is an important modern permanent magnet material. However there still remains doubt as to the magnetization reversal mechanism which controls coercivity in material prepared by this processing route. To investigate this problem a new technique based on measurements of reversible magnetization along recoil curves has been used. The technique identifies the presence of free domain walls during magnetic reversal. For this study samples of isotropic (MQI), hot pressed (MQII) and die upset (MQIII) melt-quenched NdFeB were examined. The results indicate that in MQI free domain walls are not present during reversal and the reversal mechanism is most likely incoherent rotation of some form. Free domain walls are also not present during reversal in the majority of grains of MQII, even though initial magnetization measurements indicate that the grain size is large enough to support them. In MQIII free domain walls are present during reversal. These results are attributed to the reduced domain wall nucleation field in MQIII compared with MQII and the increased dipolar interactions in MQIII.

NTIS

Magnetization; Boron Alloys; Neodymium Alloys; Iron Alloys; Permanent Magnets

19990103371 Los Alamos National Lab., NM USA

3D modeling of metallic grain growth

George, D.; Carlson, N.; Gammel, J. T.; Kuprat, A.; Dec. 31, 1999; 4p; In English; MSM '99 conference

Report No.(s): DE99-002737; LA-UR-99-986; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper will describe simulating metallic grain growth using the Gradient Weighted Moving Finite Elements code, GRAIN3D. The authors also describe the set of mesh topology change operations developed to respond to changes in the physical

topology such as the collapse of grains and to maintain uniform calculational mesh quality. Validation of the method is demonstrated by comparison to analytic calculations. The authors present results of multigrain simulations where grain boundaries evolve by mean curvature motion and include results which incorporate grain boundary orientation dependence.

NTIS

Metals; Mathematical Models; Computer Programs; Crystal Growth; Finite Element Method; Simulation

19990104049 Naval Postgraduate School, Monterey, CA USA

Investigation into the Mechanism of Acicular Ferrite Nucleation in Steel Weld Metal

Mahony, Michael F.; Jun. 1999; 97p; In English

Report No.(s): AD-A367290; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche

Although steel with its high strength and toughness has been used extensively in all facets of construction, the joining of steels through welding has been problematic at best. The weld itself is the weakest part in any structure. This belief has been pervasive until recently when a microstructure called acicular ferrite was discovered. Acicular ferrite forms on non-metallic inclusions found within the weldment and when significant amounts are "grown", the weldment's toughness and strength approaches that of the steel-base plate. Unfortunately, the mechanism by which high level of acicular ferrite is nucleated in steel weld metal is unknown. This thesis is ground-breaking work in understanding this process and factors that can influence acicular ferrite formation. The present work has found that titanium-rich inclusions are the strongest acicular ferrite formers available, and goes on to suggest a new, undocumented compound may form if the proper amounts of titanium and aluminum within the weld are produced. The applications are far reaching as steel is used by all services for most all equipment.

DTIC

Nucleation; Steels; Welded Joints; Iron

19990104262 General Electric Co., Schenectady, NY USA

Thermal stability of high temperature structural alloys

Jordan, C. E.; Rasefske, R. K.; Castagna, A.; Mar. 31, 1999; 9p; In English; 1999 TMS international symposium on advances in twinning annual meeting

Report No.(s): DE99-002679; KAPL-P-000213; K-99023; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

High temperature structural alloys were evaluated for suitability for long term operation at elevated temperatures. The effect of elevated temperature exposure on the microstructure and mechanical properties of a number of alloys was characterized. Fe-based alloys (330 stainless steel, 800H, and mechanically alloyed MA 956), and Ni-based alloys (Hastelloy X, Haynes 230, Alloy 718, and mechanically alloyed MA 758) were evaluated for room temperature tensile and impact toughness properties after exposure at 750 C for 10,000 hours. of the Fe- based alloys evaluated, 330 stainless steel and 800H showed secondary carbide (M23C6) precipitation and a corresponding reduction in ductility and toughness as compared to the as-received condition. Within the group of Ni- based alloys tested, Alloy 718 showed the most dramatic structure change as it formed delta phase during 10,000 hours of exposure at 750 C with significant reductions in strength, ductility, and toughness. Haynes 230 and Hastelloy X showed significant M23C6 carbide precipitation and a resulting reduction in ductility and toughness. Haynes 230 was also evaluated after 10,000 hours of exposure at 850, 950, and 1050 C. For the 750--950 C exposures the M23C6 carbides in Haynes 230 coarsened. This resulted in large reductions in impact strength and ductility for the 750, 850 and 950 C specimens. The 1050 C exposure specimens showed the resolution of M23C6 secondary carbides, and mechanical properties similar to the as- received solution annealed condition.

NTIS

Heat Resistant Alloys; Microstructure; Mechanical Properties; Temperature Effects; Thermal Stability; Alloying; Carbides

19990104325 NASA Lewis Research Center, Cleveland, OH USA

Volatile Hydroxide Species of Common Protective Oxides and their Role in High Temperature Corrosion

Opila, Elizabeth J., Cleveland State Univ., USA; Jacobson, Nathan S., NASA Lewis Research Center, USA; Electrochemical Society Proceedings; 1996; Volume 96, No. 26, pp. 269-281; In English; 190th; Fundamental Aspects of High Temperature Corrosion, Oct. 1996; Sponsored by Electrochemical Society, Inc., USA

Contract(s)/Grant(s): RTOP 537-04-22; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Thermodynamic data for volatile hydroxides and oxyhydroxides formed from the reaction of water vapor with Cr_2O_3, SiO_2, Al_2O_3, Y_2O_3, and ZrO_2 were assembled. The volatile species formed at temperatures between 800 and 2200K in model combustion environments containing 10% water vapor and 10% oxygen at 1 and 10 bar total pressure were calculated using free energy minimization techniques. Assuming an acceptable maximum vapor pressure limit for volatile species of 10 bar, an upper use tem-

perature for these oxides was determined at 1 and 10 bar total pressure. The dependence of these volatile species on both water vapor and oxygen pressure was determined.
Author
Chromium Oxides; High Temperature; Hydroxides; Oxides; Silicon Dioxide; Thermodynamics; Vapor Pressure; Water Vapor; Zirconium Oxides; Combustion; Volatility

19990104336 NASA Marshall Space Flight Center, Huntsville, AL USA
Bridgman Growth of GeSi Alloys in a Static Magnetic Field
Volz, M. P., NASA Marshall Space Flight Center, USA; Szofran, F. R., NASA Marshall Space Flight Center, USA; Vujisic, L., Cape Simulations, Inc., USA; Motakef, S., Cape Simulations, Inc., USA; 1998; 1p; In English; 12th; Crystal Growth, 26-31 Jul. 1998, Jerusalem, Israel; No Copyright; Avail: Issuing Activity (NASA, Marshall Space Flight Center, Huntsville, AL); Abstract Only, Hardcopy, Microfiche
Ge(0.95)Si(0.050 alloy crystals have been grown by the vertical Bridgman technique, both with and without an axial 5 Tesla magnetic field. The crystals were processed in a constant axial thermal gradient and the effects of graphite, hot pressed boron nitride, and pyrolitic boron nitride ampoule materials on interface shapes and macrosegregation profiles were investigated. The sample grown in a graphite ampoule at 5 Tesla exhibited a macroscopic axial concentration profile close to that of complete mixing and strong striation patterns. In samples grown in boron nitride ampoules, both with and without a 5 Tesla magnetic field applied, measured macroscopic axial concentration profiles were intermediate between those expected for a completely mixed melt and diffusion-controlled growth, and striation patterns were also observed. Possible explanations for the apparent inability of the magnetic field to reduce the flow velocities to below the growth velocities are discussed, and results of growth experiments in pyrolitic boron nitride ampoules are also described.
Author
Boron Nitrides; Bridgman Method; Magnetic Fields; Ampoules; Germanium Alloys

19990104380 National Renewable Energy Lab., Golden, CO USA
Metalcasting: Filtering Molten Metal
Poole, Lauren, National Renewable Energy Lab., USA; Recca, Lee, National Renewable Energy Lab., USA; Jan. 29, 1999; 379p; In English
Report No.(s): DE00-004134; NEL/FS-330-25863; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
A more efficient method has been created to filter cast molten metal for impurities. Read about the resulting energy and money savings that can accrue to many different industries from the use of this exciting new technology.
NTIS
Filters; Liquid Metals; Casting

19990104383 National Renewable Energy Lab., Golden, CO USA
Metalcasting: Die Casting Copper Motor Rotors
Recca, Lee, National Renewable Energy Lab., USA; Jan. 29, 1999; 379p; In English
Report No.(s): DE00-003950; NREL/FS-330-25029; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
Decreased energy requirements, air emissions, production time, and operating costs are some of the benefits that will accrue to the metalcasting industry as as result of this new die casting technique. This fact sheet provides the details of this exciting new process for fabricating copper motor rotors.
NTIS
Casting; Copper; Rotors; Fabrication

19990104384 National Renewable Energy Lab., Golden, CO USA
Metalcasting: A Process to Recover and Reuse Sulfur Dioxide Used in Forming Cold Box Molds for Metalcasting
Blazek, Steve, National Renewable Energy Lab., USA; Jan. 29, 1999; 379p; In English
Report No.(s): DE00-003804; NREL/FS-330-25987; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
As this fact sheet explains, there are several potential uses for this new process to recover and reuse sulfur dioxide for metalcasting operations. Employing this process will reduce energy consumption, eliminate the need for caustic effluent, and pay back in less than one year.
NTIS
Sulfur Dioxides; Casting; Recycling; Materials Recovery

19990105821 NASA Marshall Space Flight Center, Huntsville, AL USA

Microstructural Development of Directionally Solidified Hg(1-x)Zn(x)Se Alloys

Cobb, S. D., NASA Marshall Space Flight Center, USA; Szofran, F. F., NASA Marshall Space Flight Center, USA; Jones, K. S., Florida Univ., USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; [1999]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Hg(1-x)Zn(x)Se alloys have been studied as an alternative to Hg(1-x)Cd(x)Te for the detection of electromagnetic radiation, because the shorter ZnSe and HgSe bonds have been predicted to improve lattice stability. Several ingots with x = 0.1 were directionally solidified using a modified Bridgman-Stockbarger method; one was grown in an applied magnetic field, which greatly reduced radial compositional variations. A method was developed to reduce wetting. This, combined with the convex liquid-solid interface shape, produced boules that were single crystalline after growing about 3.5 cm. Observed surface features indicated ampoule wetting was eliminated using a graphite getter. Microstructural characteristics were greatly improved over HgCdTe alloys. In six boules, a total of only one twin was observed. A method for polishing and producing dislocation etch pits was developed for these alloys, revealing dislocation etch pit densities one to two orders of magnitude less than HgTe-based alloys. A kink in the thermal profile during processing of one boule generated more dislocations than did lattice mismatch due to compositional variations. This alloy has improved microstructural properties and resistance to dislocation formation compared with similar II-VI alloys.
Author

Bridgman Method; Microstructure; Single Crystals; Directional Solidification (Crystals); Crystal Growth; Crystallography

19990106244 NASA Marshall Space Flight Center, Huntsville, AL USA

Vacuum Plasma Spray (VPS) Forming of Solar Thermal Propulsion Components Using Refractory Metals

Zimmerman, Frank, NASA Marshall Space Flight Center, USA; Gerish, Harold, NASA Marshall Space Flight Center, USA; Davis, William, NASA Marshall Space Flight Center, USA; Hissam, D. Andy, NASA Marshall Space Flight Center, USA; 1998; In English; National Thermal Spray, 13 Oct. 1998, Chicago, IL, USA; Sponsored by American Society for Metals, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Thermal Spray Laboratory at NASA's Marshall Space Flight Center has developed and demonstrated a fabrication technique using Vacuum Plasma Spray (VPS) to form structural components from a tungsten/rhenium alloy. The components were assembled into an absorption cavity for a fully-functioning, ground test unit of a solar thermal propulsion engine. The VPS process deposits refractory metal onto a graphite mandrel of the desired shape. The mandrel acts as a male mold, forming the required contour and dimensions of the inside surface of the deposit. Tungsten and tungsten/25% rhenium were used in the development and production of several absorber cavity components. These materials were selected for their high temperature (less than 2500 C) strength. Each absorber cavity comprises 3 coaxial shells with two, double-helical flow passages through which the propellant gas flows. This paper describes the processing techniques, design considerations, and process development associated with forming these engine components.
Author

Vacuum; Plasmas (Physics); Sprayers; Solar Thermal Propulsion; Procedures; Technology Assessment; Refractory Metals

19990106257 Defence Science and Technology Organisation, Aeronautical and Maritime Research Lab., Fishermens Bend, Australia

Analysis of Cyclic Mean Stress Relaxation and Strain Ratchetting Behaviour of Aluminium 7050

Hu, W.; Wang, C. H.; Barter, S.; Jun. 1999; 39p; In English
Report No.(s): AD-A367233; DSTRO-RR-0153; DODA-AR-010-989; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The cyclic constitutive behaviour of aluminium 7050 under elstoplastic deformation has been investigated in this report. Experiments were performed under strain-controlled and stress-controlled cyclic loading, respectively, with a view to quantify the phenomena of mean stress relaxation and strain ratchetting. to mathematically describe the experimentally observed cyclic stress-strain behaviour, the framework of constitutive theory for rate-independent plasticity has been reviewed and the state-of-art development in the field summarized. A detailed discussion has been presented for a class of constitutive models which uses nonlinear differential equations to describe the kinematic hardening, using a single back stress or multiple back stresses. Using the available steady-state experimental data, the material constants in the model have been identified. A comparison to the experimental results shows that the model can provide very good representation of the material stress-strain behaviour under cyclic loading,

in terms of the general shape of hysteresis loops. A numerical procedure for determining the notch-root stress and strain from the applied remote stress or strain has also been developed. The significance of strain ratchetting on the prediction of fatigue crack initiation and growth life has also been discussed. Further study is needed to improve the accuracy of prediction in the rate of stress relaxation.

DTIC

Metals; Aluminum Alloys; Stress Relaxation; Stress-Strain Relationships; Mathematical Models

27
NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials. For composite materials see 24 Composite Materials.

19990100878 NASA Marshall Space Flight Center, Huntsville, AL USA

Nonlinear Optothermal Properties of Metal-Free Phthalocyanine

Abdeldayem, Hossin A., Universities Space Research Association, USA; Frazier, Donald O., NASA Marshall Space Flight Center, USA; Penn, Benjamin G., NASA Marshall Space Flight Center, USA; Smith, David D., NASA Marshall Space Flight Center, USA; Banks, Curtis E., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The nonlinear optical properties of metal-free phthalocyanine (MFPC) thin films were examined using the second harmonic at 532 nm from a pulsed Nd:YAG laser, and the cw He-Ne , and Ar+ lasers. The He-Ne laser transmission at fixed input intensity was found to increase temporally within a time scale of twelve hours. The origin of this temporal change of transmission is discussed. The third order nonlinear susceptibilities (chi (exp(3))) by four-wave mixing were measured for films of different thickness. The saturation intensity of MFPC, and its absorption cross section, at 633 nm from a He-Ne laser, are reported. An optical bistability was recorded using a He-Ne laser. An AND logic gate was also demonstrated in the system. These phenomena in the system are attributed to refractive index modulation by thermal excitations.

Author

Helium-Neon Lasers; Nonlinear Optics; Nonlinearity; Phthalocyanin; Thin Films; Logic Circuits

19990100887 Kinki Univ., Faculty of Engineering, Hiroshima, Japan

Effects of H2SO4 doping on KrF laser ablation of polyaniline films

Tsubakihara, Hiroshi, Kinki Univ., Japan; Yosimura, Hitoshi, Kinki Univ., Japan; Kondoh, Tsukasa, Kinki Univ., Japan; Research Reports of the Faculty of Engineering, Kinki University; 1995; ISSN 0386-491X, No. 29, pp. 13-16; In Japanese; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The surfaces of H2SO4 doped and undoped polyaniline obtained by KrF excimer laser irradiation in air were studied and compared. As the irradiation progressed, the surface morphology of both samples changed from a relatively smooth to a granular structure. Scanning Electron Microscopy (SEM) analysis showed, however, the surface roughness of the doped samples were less affected by the irradiation than that of undoped ones. The UV-V absorption spectra of undoped samples fairly unchanged by the irradiation, but the spectra of the doped ones of after the irradiation clearly distinguished from the spectra of that of before irradiation.

Author

Excimer Lasers; Laser Outputs; Laser Ablation; Sulfuric Acid; Irradiation; Additives

19990100888 Kinki Univ., Faculty of Engineering, Hiroshima, Japan

Optical Characteristics of KrF-Laser-Irradiated Silica Glasses

Okada, Kazuyuki, Kinki Univ., Japan; Nohchi, Kaoru, Kinki Univ., Japan; Tsubakihara, Hiroshi, Kinki Univ., Japan; Sakamoto, Akihiko, Kinki Univ., Japan; Research Reports of the Faculty of Engineering, Kinki University; 1995; ISSN 0386-491X, No. 29, pp. 7-11; In Japanese; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Transmission characteristics of OH containing silica glasses were investigated under KrF excimer laser (wavelength 248 nm) irradiation. Absorption bands were observed at 215 nm and 260 approximately 700 nm wide range in the silica containing 1 ppm OH. The 215 nm absorption band in the silica containing 200 ppm OH was relaxed more rapidly at room temperature than that

in 1 ppm OH. In OH 800 ppm, no absorption band was observed over 200 approximately 700 nm range. The high OH containing silica glass would be available as optical material for KrF laser.

Author

Optical Properties; Irradiation; Laser Outputs; Silica Glass; Excimer Lasers; Transmission

19990100973 National Renewable Energy Lab., Golden, CO USA

Characterization of SnO2 Films Prepared Using Tin Tetrachloride and Tetra Methyl Tin Precursors

Young, D., National Renewable Energy Lab., USA; Oct. 31, 1998; 379p; In English; National Center for Photovoltaics Program Review Meeting, 8-11 Sep. 1998, Denver, CO, USA

Report No.(s): DE00-005061; NREL/CP-520-25733; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

    We have investigated the effect of deposition conditions of SnO2 films, deposited by chemical vapor deposition using tin tetrachloride and tetramethyltin precursors, on the film properties. The type of precursor and the deposition temperature affect the morphology of the films. The structure of the films is determined by the deposition temperature: films deposited at low temperatures show a mixed SnO and SnO2 phase. The processing temperature and type of substrate determine the impurity content in the films. Electrical properties (e.g. the carrier mobility) and optical properties of the films are affected by the structure and the impurity content in these layers.

NTIS

Tin Oxides; Vapor Deposition; Morphology; Physical Properties; Tin

19990101881 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Development of Water-Reducible Polyurethane Coating for Military Applications *Final Report, Aug. 1997 - Aug. 1998*

Escarsega, John A.; Crawford, Dawn M.; Duncan, Jeffrey L.; Chesonis, Kestutis G.; May 1999; 33p; In English

Contract(s)/Grant(s): Proj-1L162618AH80

Report No.(s): AD-A364896; ARL-TR-1950; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    The U.S. Army Research Laboratory's Coating Research Team has developed a water-reducible (WR) chemical agent resistant coating (CARC) utilizing hydroxy-functional polyurethane dispersions and water-dispersible polyisocyanates. This coating has met the Army requirement for chemical agent resistance, while having a volatile organic compound (VOC) content of less than 220 g/l, and it provides improved weather durability, flexibility, and mar resistance. It has undergone field application testing at Letterkenny Army Depot and at Fort Sill. A military specification is being developed, and U.S. Patent #5,691,410 has been awarded. Since CARC is used on a wide variety of Department of Defense (DoD) equipment, users include painting installations across DoD (such as Army Depots, Marine Corps Logistics Bases, and Air Force Logistics Centers) and original equipment manufacturers. Application of the WR CARC at these sites can reduce VOC emissions by millions of pounds per year and, combined with the improved performance properties, will potentially avert costly expenditures for pollution abatement equipment while sustaining all Army mission requirements.

DTIC

Organic Compounds; Coatings; Volatility

19990102049 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA

Applicability of certain Monte Carlo methods to the analysis of interacting polymers

Krapp, D. M.; May 31, 1998; 150p; In English

Report No.(s): DE98-056107; LBNL-41775; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

    The authors consider polymers, modeled as self-avoiding walks with interactions on a hexagonal lattice, and examine the applicability of certain Monte Carlo methods for estimating their mean properties at equilibrium. Specifically, the authors use the pivoting algorithm of Madras and Sokal and Metroplis rejection to locate the phase transition, which is known to occur at (beta)(sub crit) (approx) 0.99, and to recalculate the known value of the critical exponent (nu) (approx) 0.58 of the system for (beta) = (beta)(sub crit) . Although the pivoting-Metropolis algorithm works well for short walks (N &amp;lt; 300), for larger N the Metropolis criterion combined with the self-avoidance constraint lead to an unacceptably small acceptance fraction. In addition, the algorithm becomes effectively non-ergodic, getting trapped in valleys whose centers are local energy minima in phase space, leading to convergence towards different values of (nu). The authors use a variety of tools, e.g. entropy estimation and histograms, to improve the results for large N, but they are only of limited effectiveness. Their estimate of (beta)(sub crit) using smaller values of N is 1.01 (+/-) 0.01, and the estimate for (nu) at this value of (beta) is 0.59 (+/-) 0.005. They conclude that even a seemingly simple system and a Monte Carlo algorithm which satisfies, in principle, ergodicity and detailed balance conditions, can in practice fail to sample phase space accurately and thus not allow accurate estimations of thermal averages. This should serve as a warning to people who use Monte Carlo methods in complicated polymer folding calculations. The structure of the phase

space combined with the algorithm itself can lead to surprising behavior, and simply increasing the number of samples in the calculation does not necessarily lead to more accurate results.
NTIS
Monte Carlo Method; Polymers

19990102904 NASA Marshall Space Flight Center, Huntsville, AL USA
Z-Scan Measurement of the Nonlinear Absorption of a Thin Gold Film
Smith, David D., NASA Marshall Space Flight Center, USA; Yoon, Youngkwon, NASA Marshall Space Flight Center, USA; Boyd, Robert W., NASA Marshall Space Flight Center, USA; Campbell, Joseph K., NASA Marshall Space Flight Center, USA; Baker, Lane A., NASA Marshall Space Flight Center, USA; Crooks, Richard M., NASA Marshall Space Flight Center, USA; George, Michael, NASA Marshall Space Flight Center, USA; [1999]; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We have used the z-scan technique at a wavelength (532 nm) near the transmission window of bulk gold to measure the nonlinear absorption coefficient of continuous approximately 50-Angstrom-thick gold films, deposited onto surface-modified quartz substrates. For highly absorbing media such as metals, we demonstrate that determination of either the real or imaginary part of the third-order susceptibility requires a measurement of both nonlinear absorption and nonlinear refraction, i.e. both open- and closed-aperture z-scans must be performed. Closed-aperture z-scans did not yield a sufficient signal for the determination of the nonlinear refraction. However, open-aperture z-scans yielded values ranging from Beta = 1.9 x 10(exp -3) to 5.3 x 10(exp -3) cm/ W in good agreement with predictions which ascribe the nonlinear response to a Fermi smearing mechanism. We note that the sign of the nonlinearity is reversed from that of gold nanoparticle composites, in accordance with the predictions of mean field theories.
Author
Absorptivity; Gold; Nonlinearity; Scanners; Thin Films; Scanning

19990102976 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Surface Measurement Techniques Temperature and Pressure Sensitive Paints
Sullivan, John P., Purdue Univ., USA; Liu, Tian–Shu, Purdue Univ., USA; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 5-1 - 5-14; In English; See also 19990102970; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

Luminescent molecular probes imbedded in a polymer binder form a temperature or pressure paint. On excitation by light of the proper wavelength, the luminescence,which is quenched either thermally or by oxygen, is detected by a camera or photodetector. From the detected luminescent intensity, temperature and pressure can be determined. Tl e basic photophysics, calibration, accuracy and the response of a luminescent paints is described followed by applications in wind tunnels and in rotating machinery.
Author
Procedures; Surface Temperature; Paints; Wavelengths; Pressure Measurement

19990102994 College of William and Mary, Williamsburg, VA USA
Formation of Metallic Nanophases in Polymeric Matrices for Space Applications *Final Report*
Orwoll, Robert A., College of William and Mary, USA; Thompson, David W., College of William and Mary, USA; [1999]; 4p; In English
Contract(s)/Grant(s): NCC1-272; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

There are a select number of polyimides which are soluble in organic media. Incorporation of hexafluoroisopropylidene groups is a route to achieving solubility. Such fluorinated polyimides have desirable properties for processing and electronic purposes; however, they often have linear coefficients of thermal expansion (CTE) which are well above those for metals and inorganic oxides or ceramics with which they might be bonded. We have developed a synthesis of composite inorganic-polyimide films using diaquotris(2,4-pentane-dionato)lanthanam(III) as the inorganic precursor and two soluble polyimides formed from 2,2-bis(3,4- dicarboxyphenyl)hexafluoro-propane (6FDA) and 1,3-bis(3-aminophenoxy)benzene (APB) or 2,2-bis[4-(4-amino-phenoxy)phenyllhexafluoropropane (4-BDAF). A primary goal of our work was to control the linear CTE in these fluorinated polymer composites without adversely affecting mechanical or other thermal properties.
Derived from text
Polymer Matrix Composites; Thermodynamic Properties; Technology Utilization; Matrix Materials; Synthesis (Chemistry)

19990103044 Los Alamos National Lab., NM USA
Substrate and growth related microstructural and magnetic properties in La(sub 0.67)SR(sub 0.33)MnO3 thin films
Hawley, M. E.; Brown, G. W.; Kwon, C.; Jia, Q.; Dec. 31, 1998; 11p; In English; 43rd; Optical science, engineering, and instrumentation
Report No.(s): DE99-002593; LA-UR-98-3356; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Ambient observation of magnetic domain structures by magnetic force microscopy (MFM) in La(sub 0.67)SR(sub 0.33)MnO3 films has not yet been clearly correlated with stresses induced by kinetic or thermodynamic growth processes or the compressive (LaAlO3) or tensile (SRTiO3) nature of the film-substrate lattice mismatch. Although domain-like magnetic structures have been seen in some as-grown films and related to substrate-induced stress and film thickness, no magnetic structure has been seen for other films grown under similar conditions on the same pair of substrates. In this study the authors have grown films over a range of temperatures by pulsed-laser deposition, using the above substrates, to determine the relationship between growth and stress-induced magnetic structures. Results from scanning tunneling, atomic force, and magnetic force microscopies, measurements of temperature-dependent magnetization and structure-dependent coercivity show the relationship between growth and magnetic properties. Maze-like domain structures, with separations between 150 nm and 200 nm, were only observed for the thicker films grown at the highest temperature, 800 C. Application of an in-plane magnetic field converted these domain structures to stripe-like domains whose spacing and out of plane component decreased as the field was increased.
NTIS
Substrates; Microstructure; Magnetic Properties; Thin Films; Manganese Oxides; Lanthanum Compounds; Strontium Compounds; Magnetic Measurement; Crystal Growth

19990103054 Sandia National Labs., Albuquerque, NM USA
Ultrahard Multilayer Coatings
Chrzan, D. C., Sandia National Labs., USA; Dugger, M., Sandia National Labs., USA; Follstaedt, D. M., Sandia National Labs., USA; Friedman, L. H., Sandia National Labs., USA; Friedmann, T. A., Sandia National Labs., USA; May 01, 1999; 79p; In English
Report No.(s): DE00-007225; SAND99-1175; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

We have developed a new multilayer a-tC material that is thick stress-free, adherent, low friction, and with hardness and stiffness near that of diamond. The new a-tC material is deposited by J pulsed-laser deposition (PLD) at room temperature, and fully stress-relieved by a short thermal anneal at 600 C. A thick multilayer is built up by repeated deposition and annealing steps. We measured 88 GPa hardness, 1100 GPa Young's modulus, and 0.1 friction coefficient (under high load). Significantly, these results are all well within the range reported for crystalline diamond. In fact, this material, if considered separate from crystalline diamond, is the 2nd hardest material known to man. Stress-free a-tC also has important advantages over thin film diamond; namely, it is smooth, processed at lower temperature, and can be grown on a much broader range of substrates. This breakthrough will enable a host of applications that we are actively pursuing in MEMs, sensors, LIGA, etc.
NTIS
Microelectromechanical Systems; Pulsed Laser Deposition; Physical Properties; Mechanical Properties; Thin Films; Coatings

19990103942 NASA Marshall Space Flight Center, Huntsville, AL USA
Comparison of Observed Beta Cloth Interactions with Simulated and Actual Space Environment
Kamenetzky, Rachel R., NASA Marshall Space Flight Center, USA; Finckenor, Miria M., NASA Marshall Space Flight Center, USA; September 1999; 1p; In English
Contract(s)/Grant(s): RTOP 478-88-00
Report No.(s): NASA/TM-1999-209575; M-936; NAS 1.15:209575; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A common component of multilayer insulation blankets is beta cloth, a woven fiberglass cloth impregnated with Teflon . It is planned for extensive use on the International Space Station. The Environmental Effects Group of the Marshall Space Flight Center Materials, Processing, and Manufacturing Department has investigated the impact of atomic oxygen (AO) and ultraviolet (UV) radiation on the optical properties of plain and aluminized beta cloth, both in the laboratory I and as part of long-duration flight experiments. These investigations indicate that beta cloth is susceptible to darkening in the presence of UV radiation, dependent on the additi%-es used. AO interactions resulted in bleaching of the beta cloth.
Author
Aerospace Environments; Oxygen Atoms; Teflon (Trademark); Multilayer Insulation; Ultraviolet Radiation; Optical Properties

19990103943 NASA Marshall Space Flight Center, Huntsville, AL USA

Optical Analysis of Transparent Polymeric Material Exposed to Simulated Space Environment

Edwards, David L., NASA Marshall Space Flight Center, USA; Finckenor, Miria M., NASA Marshall Space Flight Center, USA; 2000; 1p; In English; 8th; Materials in a Space Environment, 5-9 Jun. 1999, Arcachon, France

Many innovations in spacecraft power and propulsion have been recently tested at NASA, particularly in non-chemical propulsion. One improvement in solar array technology is solar concentration using thin polymer film Fresnel lenses. Weight and cost savings were proven with the Solar Concentrator Arrays with Refractive Linear Element Technology (SCARLET)-II array on NASA's Deep Space I spacecraft. The Fresnel lens concentrates solar energy onto high-efficiency solar cells, decreasing the area of solar cells needed for power. Continued efficiency of this power system relies on the thin film's durability in the space environment and maintaining transmission in the 300 - 1000 nm bandwidth. Various polymeric materials have been tested for use in solar concentrators, including Lexan(TM), polyethylene terephthalate (PET), several formulations of Tefzel(Tm) and Teflon(TM), and DC 93-500, the material selected for SCARLET-II. Also tested were several innovative materials including Langley Research Center's CPI and CP2 polymers and atomic oxygen- resistant polymers developed by Triton Systems, Inc. The Environmental Effects Group of the Marshall Space Flight Center's Materials, Processes, and Manufacturing Department exposed these materials to simulated space environment and evaluated them for any change in optical transmission. Samples were exposed to a minimum of 1000 equivalent Sun hours of near-UV radiation (250 - 400 nm wavelength). Materials that appeared robust after near-UV exposure were then exposed to charged particle radiation equivalent to a five-year dose in geosynchronous orbit. These exposures were performed in MSFC's Combined Environmental Effects Test Chamber, a unique facility with the capability to expose materials simultaneously or sequentially to protons, low-energy electrons, high-energy electrons, near UV radiation and vacuum UV radiation. Reflectance measurements can be made on the samples in vacuum. Prolonged exposure to the space environment will decrease the polymer film's transmission and thus reduce the conversion efficiency. A method was developed to normalize the transmission loss and thus rank the materials according to their tolerance to space environmental exposure. Spectral results and the material ranking according to transmission loss are presented.
Author

Optical Data Processing; Transparence; Polyethylene Terephthalate; Exposure; Environment Effects

19990104281 NASA Lewis Research Center, Cleveland, OH USA

Polyimides Based on 4,4'-BIS(4-Aminophenoxy)-2,2' or 2,2', 6,6'-Substituted Biphenyl

Chuang, Chun–Hua K., Inventor, NASA Lewis Research Center, USA; Aug. 17, 1999; In English; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

This invention relates the novel diamines. the polyimide oligomers and the polyimides derived therefrom and to the method of preparing the diamines. oligomers and the poly- imides. The thermoplastic polyimides derived from the aromatic diamines of this invention are characterized as having a high glass transition temperature. good mechanical properties and improved processability in the manufacture of adhesives. electronic and composite materials for use in the automotive and aerospace industry.Me distinction of the novel aromatic diamines of this invention is the 2.2'.6.6- substituted biphenyl radicals which exhibit noncoplanar conformation that enhances the solubility of the diamine as well as the processability of the polyimides. while retaining a realatively high glass transition temperature and improved mechanical properties at useful temperature ranges.
Official Gazette of the U.S. Patent and Trademark Office

Procedures; Adhesives; Diamines; Polyimides; Polyphenyls; Oligomers; Mechanical Properties

19990104282 NASA Johnson Space Center, Houston, TX USA

Distributed Pore Chemistry in Porous Organic Polymers in Tissue Culture Flasks

Koontz, Steven L., Inventor, NASA Johnson Space Center, USA; Aug. 17, 1999; In English; Div. of US-Patent-Appl-SN-254361, filed 3 Jun. 1994, continuation-in-part of US-Patent-Appl-SN-857901, filed 26 Mar. 1992 and US-Patent-Appl-SN-997265, filed 23 Feb. 1993, div. of US-Patent-Appl-SN-894505 and US-Patent-Appl-SN-429739

A method for making a biocompatible polymer article using a uniform atomic oxygen treatment is disclose. The substrate may be subsequently optionally grated with a compatibilizing compound. Compatibilizing compounds may include proteins, phosphorylcholine groups, platelet adhesion preventing polymers, albumin adhesion promoters, and the like. The compatibilized substrate may also have a living cell layer adhered thereto. The atomic oxygen is preferably produced by a flowing afterglow microwave discharge, wherein the substrate resides in a sidearm out of the plasma. Also, methods for culturing cells for various

purposes using the various membranes are disclosed as well. Also disclosed are porous organic polymers having a distributed pore chemistry (DPC) comprising hydrophilic and hydrophobic regions, and a method for making the DPC by exposing the polymer to atomic oxygen wherein the rate of hydrophilization is greater than the rate of mass loss.
Author
Culture Techniques; Tissues (Biology); Cells (Biology); Porosity; Porous Materials

19990104283 NASA Ames Research Center, Moffett Field, CA USA
Waterproof Silicone Coatings of Thermal Insulation and Vaporization Method
Cagliostro, Domenick E., Inventor, NASA Ames Research Center, USA; Aug. 17, 1999; In English
Patent Info.: Filed 11 Aug. 1997; NASA-Case-ARC-14120-1-GE; US-Patent-5,939,141; US-Patent-Appl-SN-909711; No Copyright; Avail: US Patent and Trademark Office, Hardcopy
     Thermal insulation composed of porous ceramic material can be waterproofed by producing a thin silicone film on the surface of the insulation by exposing it to volatile silicone precursors at ambient conditions. When the silicone precursor reactants are multi-functional siloxanes or silanes containing alkenes or alkynes carbon groups higher molecular weight films can be produced. Catalyst are usually required for the silicone precursors to react at room temperature to form the films. The catalyst are particularly useful in the single component system e.g. dimethylethoxysilane (DNMS) to accelerate the reaction and decrease the time to waterproof and protect the insulation. In comparison to other methods, the chemical vapor technique assures better control over the quantity and location of the film being deposited on the ceramic insulation to improve the waterproof coating.
Official Gazette of the U.S. Patent and Trademark Office
Thermal Insulation; Waterproofing; Silicones; Vaporizing; Porous Materials

19990104284 NASA Johnson Space Center, Houston, TX USA
Distributed Pore Chemistry in Porous Organic Polymers
Koontz, Steven L., Inventor, NASA Johnson Space Center, USA; Aug. 10, 1999; In English; Div. of US-Patent-Appl-SN-254361, filed 3 Jun. 1994, continuation-in-part of US-Patent-Appl-SN-857901, filed 26 Mar. 1992 and US-Patent-Appl-SN-997265, filed 23 Feb. 1993, div. of US-Patent-Appl-SN-894505 and US-Patent-Appl-SN-429739
Patent Info.: Filed 9 Jul. 1997; NASA-Case-MSC-22419-3; US-Patent-5,935,845; US-Patent-Appl-SN-903281; US-Patent-Appl-SN-254361; US-Patent-Appl-SN-857901; US-Patent-Appl-SN-997265; US-Patent-Appl-SN-894505; US-Patent-Appl-SN-429739; No Copyright; Avail: US Patent and Trademark Office, Hardcopy
     A method for making a biocompatible polymer article using a uniform atomic oxygen treatment is disclosed. ne substrate may be subsequently optionally grated with a cormpatibilizing compound. Compatibilizing compounds may include proteins, phosphorylcholine groups, platelet adhesion preventing polymers. albumin adhesion promoters, and the like. The compatibilized substrate may also have a living cell layer adhered thereto. The atomic oxygen is preferably produced by a flowing afterglow microwave discharge. wherein the substrate resides in a sidearm out of the plasma. Also. methods for culturing cells for various purposes using the various membranes are disclosed as well. Also disclosed are porous organic polymers having a distributed pore chemistry (DPC) comprising hydrophilic and hydrophobic regions. and a method for making the DPC by exposing the polymer to atomic oxygen wherein the rate of hydrophilization is greater than the rate of mass loss.
Official Gazette of the U.S. Patent and Trademark Office
Procedures; Polymers; Adhesion; Microwaves; Proteins

19990104337 NASA Marshall Space Flight Center, Huntsville, AL USA
Commercial Production of Heavy Metal Fluoride Glass Fiber in Space
Tucker, Dennis S., NASA Marshall Space Flight Center, USA; Workman, Gary L., Alabama Univ., USA; Smith, Guy A., Alabama Univ., USA; 1998; 1p; In English; Space Technology and Applications International Forum, 25-29 Jan. 1998, Albuquerque, NM, USA; No Copyright; Avail: Issuing Activity (NASA, Marshall Space Flight Center, Huntsville, AL), Hardcopy, Microfiche
     International Space Station Alpha (ISSA) will provide a platform not only for materials research but also a possible means to produce products in space which cannot be easily produced on the ground. Some products may even be superior to those now produced in unit gravity due to the lack of gravity induced convection effects. Our research with ZrF4-BaF2-LaF3-AlF3-NaF (ZBLAN glass) has shown that gravity does indeed play a major role in the crystallization behavior of this material. At the present time ZBLAN is being produced on earth in fiber optic form for use in surgical lasers and fiber optic lasers among other applications. High attenuation coefficients, however, have kept this material from being used in other applications such as long haul data

transmission links. The high attenuation coefficients are due to impurities which can be removed through improved processing techniques and crystals which can only be removed or prevented from forming by processing in a reduced gravity environment. Author

Metal Fluorides; Barium Fluorides; Fiber Optics; Glass Fibers

19990104338 NASA Marshall Space Flight Center, Huntsville, AL USA

Processing Glass Fiber from Moon/Mars Resources

Tucker, Dennis S., NASA Marshall Space Flight Center, USA; Ethridge, Edwin C., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Proceedings of American Society of Civil Engineers Conference, 26-30 Apr. 1998, Albuquerque, NM, USA; No Copyright; Avail: Issuing Activity (NASA, Marshall Space Flight Center, Huntsville, AL); Abstract Only, Hardcopy, Microfiche

Processing of Lunar/Mars raw materials into usable structural and thermal components for use on a Lunar/Mars base will be essential for human habitation. One such component will be glass fiber which can be used in a number of applications. Glass fiber has been produced from two lunar soil simulants. These two materials simulate lunar mare and lunar highlands soil compositions. Short fibers containing recrystallized areas were produced from the as-received simulants. Doping the highland simulant with 8 weight percent boria yielded a material which could be spun continuously. The effects of lunar gravity on glass fiber formation were studied utilizing NASA's KC 135 aircraft. Gravity was found to play a role in crystallization and final fiber diameter. Author

Glass Fibers; Lunar Soil; Lunar Gravitation; Lunar Maria

19990105688 Norwegian Defence Research Establishment, Kjeller, Norway

Thermal Decontamination of Protective Suits: Preliminary Studies

Watterud, Geir, Norwegian Defence Research Establishment, Norway; Apr. 04, 1999; 16p; In English

Contract(s)/Grant(s): Proj. FFIBM/757/138

Report No.(s): FFI/RAPPORT-99/03992; ISBN 82-464-0360-5; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Thermal decontamination of protective suit material with activated carbon in polyurethane foam has been investigated. Decontamination with humid air at 110 C and dry air at 150 C gave the most promising results. However, penetration analysis shows that the protective ability was not completely re-established at any of these two temperatures, probably due to incomplete removal of the contaminants from the active charcoal. However, the results were promising enough to justify further investigations. Author

Decontamination; Protective Clothing; Thermal Protection

19990105886 Sandia National Labs., Albuquerque, NM USA

Predicting Microstructural-Level Residual Stresses and Crack Paths in Ceramics

Cater, W. C.; Glass, S. J.; Rohrer, G. S.; Saylor, D. M.; Vedula, V. R.; May 19, 1999; 7p; In English; 12th; Twelfth International Conference on Textures of Materials, 9-13 Aug. 1999, Montreal, Canada

Report No.(s): DE00-007262; SAND99-1276C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Microstructural-level residual stresses arise in ceramics due to thermal expansion anisotropy. The magnitude of these stresses can be very high and may cause spontaneous microcracking during the processing of these materials. The orientation data obtained by backscattered electron diffraction and grain boundary energies obtained by AFM were used in conjunction with an object oriented finite element analysis package (OOF) to predict the magnitude of residual stresses in alumina. Crack initiation and propagation were also simulated based on the Griffith fracture criterion. NTIS

Ceramics; Crack Propagation; Residual Stress; Thermal Expansion; Predictions; Backscattering

19990106253 Sandia National Labs., Albuquerque, NM USA

Spall Strength Measurements of Concrete for Varying Aggregate Sizes

Chhabildas, L. C.; Kipp, M. E.; Reinhart, W. D.; Wilson, L. T.; May 05, 1999; 12p; In English; 15th; Solid Mechanics, 11-14 Apr. 1999, Myrtle Beach, SC, USA

Report No.(s): DE00-007237; SAND99-1128C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Controlled impact experiments have been performed to determine the spall strength of four different concrete compositions. The four concrete compositions are identified as, "SAC-5, CSPC", ("3/4") large, and ("3/8") small, Aggregate. They differ primarily in aggregate size but with average densities varying by less than five percent. Wave profiles from sixteen experiments, with

shock amplitudes of 0.07 to 0.55 GPa, concentrate primarily within the elastic regime. Free-surface particle velocity measurements indicate consistent pullback signals in the release profiles, denoting average span strength of approximately 40 MPa. It is the purpose of this paper to present spall measurements under uniaxial strain loading. Notwithstanding considerable wave structure that is a unique characteristic to the heterogeneous nature of the scaled concrete, the spall amplitudes appear reproducible and consistent over the pressure range reported in this study.

NTIS

Concretes; Spallation; Impact Tests; Mechanical Properties

28
PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 44 Energy Production and Conversion.

19990103927 Foster Associates, Inc., San Francisco, CA USA

History of Coastal Alabama Natural Gas Exploration and Development *Final Report*

Wade, W. W.; Plater, J. R.; Kelley, J. Q.; May 1999; 226p; In English

Report No.(s): PB99-167389; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

This study documents the development and growth of the natural gas industry offshore Alabama. This report provides a full account of natural gas discover, Mobile Bay leasing, industry exploration, industry development projects and production history. A gas production forecast is developed for the Mobile Bay region with and without proposed development of the Destin Dome OCS in the Eastern Gulf of Mexico. Coastal Alabama Norphlet and Miocene production will rise to 1.4 BCFD by 2000. Destin Dome's production come online after Mobile Bay production from discovered reserves reaches peak, thereby sustaining supplies to interstate markets in the 1.4-1.6 BCFD through 2005. Combining both the Alabama state and federal OCS offshore production, the Alabama-Destin Dome production forecast reaches and sustains 1.6 BCFD between 2002-2004.

NTIS

Natural Gas; Natural Gas Exploration; Oil Exploration; Offshore Energy Sources; Drilling; Oil Fields

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MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications. For biological materials see 55 Space Biology.

19990100862 NASA Marshall Space Flight Center, Huntsville, AL USA

Material Science Experiments on Mir

Kroes, Roger L., NASA Marshall Space Flight Center, USA; 1999; In English; 13th; Microgravity Science and Space Processing, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper describes the microgravity materials experiments carried out on the Shuttle/Mir program. There were six experiments, all of which investigated some aspect of diffusivity in liquid melts. The Liquid Metal Diffusion (LMD) experiment investigated the diffusivity of molten Indium samples at 185 C using a radioactive tracer, In-114m. by monitoring two different gamma ray energies (190 keV and 24 keV) emitted by the samples it was possible to measure independently the diffusion rates in the bulk and at the surface of the samples. The Queens University Experiment in Liquid Diffusion (QUELD) was the furnace facility used to process 213 samples for the five other experiments. These experiments investigated the diffusion, ripening, crystal growth, and glass formation in metal, semiconductor, and glass samples. This facility had the capability to process samples in an isothermal or gradient configuration for varying periods of time at temperatures up to 900 C. Both the LMD and the QUELD furnaces were mounted on the Microgravity Isolation Mount (MIM) which provided isolation from g-jitter. All the microgravity experiments were supported by the Space Acceleration Measurement System (SAMS); a three head three axes acceleration monitoring system which measured and recorded the acceleration environment.

Author

Diffusivity; Spaceborne Experiments; Indium; Liquid Metals; Semiconductors (Materials); Microgravity; Gravitational Effects; Acceleration Measurement

Mechanics of Granular Materials (MGM) Microgravity Experiment
Alshibli, Khalid A., Alabama Univ., USA; Sture, Stein, Alabama Univ., USA; 1998; In English; Third Phase 1 Research Program Results Symposium, 5 Nov. 1998, Huntsville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

    The second series of MGM experiment was conducted during the STS-89 mission in January 1998. The experiment was previously flow on Atlantis's STS-79 mission in September 1996. Six displacement-controlled, drained triaxial compression experiments were performed at very low effective confining stresses. The confining stresses were in the ranges 0.05, 0.52 and 1.30 kPa. Three experiments were subjected to monotonic loading and unloading cycles while the other three experiments were subjected to cyclic loading. The results show very high peak strength friction angles in the range of 47.6 to 70.0 degrees, which are mainly due to overconsolidation and grain interlocking effects. It was observed that the residual strength levels in the monotonic loading experiments were in the same range as that observed at higher confining stress levels. The dilatancy angles were unusually high in the range of 30 to 31 degrees. All specimens display substantial initial stiffnesses and elastic moduli during unloading and reloading events, which are nearly an order of magnitude higher than conventional theories predict. A periodic instability phenomenon which appears to result from buckling of multiple internal arches and columnar systems, augmented by stick-slips was observed in the experiments. Computed Tomography (CT) measurements revealed valuable data about the internal fabric and the specimens deformation patterns. Uniform diffuse bifurcation with multiple radial shear bands was observed in the specimens tested in a microgravity environment. In the axial direction, two major conical surfaces were developed. Spatial nonsymmetrical deformations were observed in specimens tested in terrestrial laboratory.
Author
Computer Aided Tomography; Cyclic Loads; Deformation; Displacement; Experimentation; Gravitational Effects; Granular Materials; Microgravity

Space Product Development of Commercial NLO Materials
Frazier, Donald O., NASA Marshall Space Flight Center, USA; Paley, Mark S., NASA Marshall Space Flight Center, USA; Penn, Benjamin G., NASA Marshall Space Flight Center, USA; Abdeldayem, Hossin A., NASA Marshall Space Flight Center, USA; Smith, David D., NASA Marshall Space Flight Center, USA; Witherow, William K., NASA Marshall Space Flight Center, USA; 1998; In English; Photonics East, 3-5 Nov. 1998, Boston, MA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

    Growth on selected substrates under various processing conditions have been useful for preparing highly oriented and otherwise promising films of organic compounds for optical thin films and waveguides. The significance of processing conditions to uniformity in thickness, degree of orientation, film quality, and optical properties for a specific processing technique is the general focus of work in this area. A study on the effect of processing conditions relevant to thin-film deposition by various techniques is particularly difficult because of the possibility that convection may play a major role in some cases. It is a goal of some researchers to produce good quality anisotropic films, therefore, an important, yet understudied, requirement should be to assess the role of gravity during certain processing methods. This may be particularly true for the vapor deposition of diacetylenes where subsequent polymerization in the crystal is topochemical and occurs readily only when neighboring monomer molecules are sufficiently close and suitably oriented. Likewise, this requirement is equally viable for the vapor deposition of certain materials such as Pcs in view of the results of microgravity experiments by 3M Corporation involving the preparation of thin films of copper Pc (CuPc). Microgravity-grown CuPc had several desirable features which indicate that the vapor growth of organic films in low-g may result in better quality films for optical and electrical applications. Indeed, other materials vapor deposited onto specific substrates in microgravity produce films potentially beneficial for electro-optic applications. A novel technique, recently discovered, for growing polydiacetylene thin films involves exposing a transparent substrate, in contact with diacetylene monomer solution, to ultraviolet (LTV) light. A polymer film deposits on the side of the substrate in contact with monomer in solution, and there are distinct gravitational effects, which influence film quality. Good quality thin films elude growth from solutions absent of uniform flow fields and homogeneous temperature distributions near the substrate surfaces. The flow fields and temperature distributions during the polymerization process by exposure to UV light details the nature of gravitational influences on this process.
Author (revised)
Crystals; Deposition; Deposits; Gravitational Effects; Microgravity; Optical Materials; Organic Compounds; Product Development; Polymerization; Thin Films; Vapor Deposition

3-D Modeling of Double-Diffusive Convection During Directional Solidification of a Non-Dilute Alloy with Application to the HgCdTe Growth Under Microgravity Conditions
Bune, Andris V., NASA Marshall Space Flight Center, USA; Gillies, Donald C., NASA Marshall Space Flight Center, USA;

Lehoczky, Sandor L., NASA Marshall Space Flight Center, USA; 1998; In English; 12th; Crystal Growth, 27 Jul. 1998, Jerusalem, Israel; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A numerical calculation for a non-dilute alloy solidification was performed using the FIDAP finite element code. For low growth velocities plane front solidification occurs. The location and the shape of the interface was determined using melting temperatures from the HgCdTe liquidus curve. The low thermal conductivity of the solid HgCdTe causes thermal short circuit through the ampoule walls, resulting in curved isotherms in the vicinity of the interface. Double-diffusive convection in the melt is caused by radial temperature gradients and by material density inversion with temperature. Cooling from below and the rejection at the solid-melt interface of the heavier HgTe-rich solute each tend to reduce convection. Because of these complicating factors dimensional rather then non-dimensional modeling was performed. Estimates of convection contributions for various gravity conditions was performed parametrically. For gravity levels higher then 1 0 -7 of earth's gravity it was found that the maximum convection velocity is extremely sensitive to gravity vector orientation and can be reduced at least by factor of 50% for precise orientation of the ampoule in the microgravity environment. The predicted interface shape is in agreement with one obtained experimentally by quenching. The results of 3-D modeling are compared with previous 2-D finding. A video film featuring melt convection will be presented.
Author
Three Dimensional Models; Diffusivity; Convection; Solidification; Mercury Cadmium Tellurides; Melts (Crystal Growth); Microgravity; Directional Solidification (Crystals)

19990102414 NASA Marshall Space Flight Center, Huntsville, AL USA

NASA's Microgravity Materials Science Program

Gillies, Donald C., NASA Marshall Space Flight Center, USA; 1998; In English; 127th, 15-19 Feb. 1998, San Antonio, TX, USA; Sponsored by Metallurgical Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Materials Science research programs are funded by NASA through the Microgravity Research Division. Such programs are normally designated as flight definition or ground based and can be awarded initially for up to four years. Selection is through a peer review process in response to a biennial NASA Research Announcement (NRA). The next announcement is due in November 1998 with proposals due in March 1999. Topics of special interest to NASA are described in the guidelines for proposal writing within the NRA. NASA's interest in materials is wide and covers a range which includes metals and alloys, ceramics, glasses, polymers, non-linear optics, aerogels and nanostructures. With increasing interest in the Human Exploration and Development of Space (HEDS) program, the materials research funded will not be exclusively devoted to processes dependent on microgravity, but will also support materials of strategic interest in meeting NASA's long range plans of interplanetary travel.
Author
Microgravity; Space Programs; NASA Programs; Metallography

19990102617 NASA Marshall Space Flight Center, Huntsville, AL USA

Utilizing Advanced Vibration Isolation Technology to Enable Microgravity Science Operations

Alhorn, Dean Carl, NASA Marshall Space Flight Center, USA; 1999; In English; 36th; Space Congress, 27-30 Apr. 1999, Cape Canaveral, FL, USA

Contract(s)/Grant(s): RTOP 398-96-02; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Microgravity scientific research is performed in space to determine the effects of gravity upon experiments. Until recently, experiments had to accept the environment aboard various carriers: reduced-gravity aircraft, sub-orbital payloads, Space Shuttle, and Mir. If the environment is unacceptable, then most scientists would rather not expend the resources without the assurance of true microgravity conditions. This is currently the case on the International Space Station, because the ambient acceleration environment will exceed desirable levels. For this reason, the g-LIMIT (Glovebox Integrated Microgravity Isolation Technology) system is currently being developed to provide a quiescent acceleration environment for scientific operations. This sub-rack isolation system will provide a generic interface for a variety of experiments for the Microgravity Science Glovebox. This paper describes the motivation for developing of the g-LIMIT system, presents the design concept and details some of the advanced technologies utilized in the g-LIMIT flight design.
Author
Vibration Isolators; Microgravity; Aerospace Systems

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NASA Marshall Space Flight Center, Huntsville, AL USA
Zero Gravity Cryogenic Vent System Concepts for Upper Stages
Flachbart, Robin, NASA Marshall Space Flight Center, USA; Holt, Barney, NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 1999 Space Crygogenics, 9-13 Jul. 1999, Montreal, Quebec, Canada; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The capability to vent in zero gravity without resettling is a technology need that involves practically all uses of sub-critical cryogenics in space. Venting without resettling would extend cryogenic orbital transfer vehicle capabilities. However, the lack of definition regarding liquid/ullage orientation coupled with the somewhat random nature of the thermal stratification and resulting pressure rise rates, lead to significant technical challenges. Typically a zero gravity vent concept, termed a thermodynamic vent system (TVS), consists of a tank mixer to destratify the propellant, combined with a Joule-Thomson (J-T) valve to extract thermal energy from the propellant. Marshall Space Flight Center's (MSFC's) Multipurpose Hydrogen Test Bed (MHTB) was used to test both spray bar and axial jet TVS concepts. The axial jet system consists of a recirculation pump heat exchanger unit. The spray bar system consists of a recirculation pump, a parallel flow concentric tube, heat exchanger, and a spray bar positioned close to the longitudinal axis of the tank. The operation of both concepts is similar. In the mixing mode, the recirculation pump withdraws liquid from the tank and sprays it into the tank liquid, ullage, and exposed tank surfaces. When energy extraction is required, a small portion of the recirculated liquid is passed sequentially through the J-T expansion valve, the heat exchanger, and is vented overboard. The vented vapor cools the circulated bulk fluid, thereby removing thermal energy and reducing tank pressure. The pump operates alone, cycling on and off, to destratify the tank liquid and ullage until the liquid vapor pressure reaches the lower set point. At that point, the J-T valve begins to cycle on and off with the pump. Thus, for short duration missions, only the mixer may operate, thus minimizing or even eliminating boil-off losses.
Derived from text
Weightlessness; Cryogenics; Vents; Upper Stage Rocket Engines; Ullage

NASA Marshall Space Flight Center, Huntsville, AL USA
Comparison of Observed Beta Cloth Interactions with Simulated and Actual Space Environment
Kamenetzy, R. R., NASA Marshall Space Flight Center, USA; Finckenor, M. M., NASA Marshall Space Flight Center, USA; September 1999; 24p; In English
Report No.(s): NASA/TM-1999-209575; NAS 1.15:209575; M-936; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A common component of multilayer insulation blankets is beta cloth, a woven fiberglass cloth impregnated with Teflon(TM). It is planned for extensive use on the International Space Station. The Environmental Etl'ects Group of the Marshall Space Flight Center Materials, Processing, and Manufacturing Department has investigated the impact of atomic oxygen (AO) and ultraviolet (UV) radiation on the optical properties of plain and aluminized beta cloth. both in the laboratory and as part of long-duration flight experiments. These investigations indicate that beta cloth is susceptible to darkening in the presence of UV radiation, dependent on the additives used. AO interactions resulted in bleaching of the beta cloth.
Author
Fabrics; Multilayer Insulation; Optical Properties; Oxygen Atoms; Ultraviolet Radiation; Earth Orbital Environments

NASA Marshall Space Flight Center, Huntsville, AL USA
The Role of Marangoni Convection for the FZ-Growth of Silicon
Dold, P., Freiburg Univ., Germany; Croll, A., Freiburg Univ., Germany; Schweizer, M., NASA Marshall Space Flight Center, USA; Kaiser, Th., NASA Marshall Space Flight Center, USA; Szofran, F., NASA Marshall Space Flight Center, USA; Nakamura, S., Nippon Electric Co. Ltd., Japan; Hibiya, T., Nippon Electric Co. Ltd., Japan; Benz, K. W., NASA Marshall Space Flight Center, USA; [1998]; In English, 28 Sep. - 2 Oct. 1998, Melbourne, Australia; Sponsored by International Astronautical Federation, Switzerland; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

In growing crystals by the floating zone (FZ) technique under microgravity, the size restriction we have under earth conditions because of the hydrostatic pressure are avoided. Further, buoyancy related convection is eliminated to a high degree. But in the case of silicon, the gravity independent thermocapillary (Marangoni) convection is time-dependent even for small zone geometries. This has been demonstrated in several Technische Experimente unter Schwerelosigkeit (TEXUS) - technical experiments under reduced gravity) flights. Thus, to really take advantage of microgravity with respect to improve crystal quality, tools are required to control Marangoni convection in space facilities. Applying magnetic fields, convection can be influenced; fluid flow can either be damped (static magnetic fields) or overlaid by a regular flow regime (rotating magnetic fields). In floating zones of 8-10mm diameter and height (Ma approximately equals 6 x 10(exp 3)), a static magnetic field of about 2OOmT is sufficient to suppress time-dependent Marangoni convection to a high degree, but in dependence on the kind and the concentration of the

added dopant, a new type of strongly pronounced dopant inhomogeneities have been detected. They are originated by thermoelectromagnetic convection. This can be avoided as well as detrimental effects on the radial dopant distribution by using rotating magnetic fields instead of static ones. Applying 75mT/50Hz to the FZ, the intensity of the dopant fluctuations is reduced to a high degree. Considering the rather low power consumption of rotating magnetic fields, this will be a useful tool for control or elimination of time-dependent Marangoni convection under microgravity. The strong time dependent character of thermocapillary flow and its influence on the temperature field has been measured in silicon half-zones for Marangoni numbers of Ma is approximately equal to 1-1.5 x 10(exp 4): temperature fluctuations up to 4C have been determined. Their frequency range was 0.1 and 0.4 Hz. Between certain thermocouple or sensor pairs, strong correlation has been detected.
Author
Crystals; Float Zones; Magnetic Fields; Marangoni Convection; Microgravity; Silicon; Crystal Growth; Crystallization

19990105818 NASA Marshall Space Flight Center, Huntsville, AL USA
Numerical Analysis of Temperature Gradients and Interface Shape During Directional Solidification of Al and Al-Cu Alloy Under Microgravity Conditions
Bune, Andris V., Universities Space Research Association, USA; Sen, Subhayu, Universities Space Research Association, USA; Stefanescu, Doru M., Alabama Univ., USA; Curreri, Peter A., NASA Marshall Space Flight Center, USA; [1999]; In English; 3rd Solidification and Gravity, 26-29 Apr. 1999, Miskolc, Hungary; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Numerical modeling was undertaken to analyze the influence of radial thermal gradient on solid/liquid interface shape and convection patterns during solidification of pure Al and Al-4 wt. % Cu alloy. Steady state calculations were performed for different gravity levels and orientations. Furthermore, transient modeling was undertaken to investigate effect of the solidification velocity. The furnace configuration used in this analysis is the proposed International Space Station Furnace. Results from a thermal model of the furnace core were used as initial boundary conditions for solidification modeling. The Solidification model was adopted from previous work and was based on the finite element code FIDAP. Thermocouple data and quenched interface shape from a pure Al sample flown on the Life Sciences and Microgravity Spacelab (LMS) mission, July 1996 was used for model validation. Good agreement was obtained between the predicted interface shape and that measured from the quenched LMS sample. It was found that the imposed temperature boundary condition must be sufficiently smooth for the heat fluxes in the model to be self-consistent. The model predicted that alloy sample Al-Cu is more sensitive to variations in the gravity level compared to pure Al. For Al-Cu alloy, solute diffusivity is approximately 10(exp 4) times smaller than thermal diffusivity of pure Al. Hence, in a microgravity environment the weak convection has no measurable effect on the heat fluxes, but is still strong enough to affect concentration distribution. Since the alloy melting temperature is determined by concentration the interface shape depends on the level of convection. This was found not to be the case for pure metal.
Author
Aluminum Alloys; Copper Alloys; Directional Solidification (Crystals); Finite Element Method; Liquid-Solid Interfaces; Microgravity; Numerical Analysis; Temperature Gradients; Models

19990105820 NASA Marshall Space Flight Center, Huntsville, AL USA
Preliminary Concepts for the Materials Science Research Facility on the International Space Station
Cobb, S.D., NASA Marshall Space Flight Center, USA; Szofran, F. R., NASA Marshall Space Flight Center, USA; Schaefer, D. A., NASA Marshall Space Flight Center, USA; [1999]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Materials Science Research Facility (MSRF) is designed to accommodate the current and evolving cadre of peer-reviewed materials science investigations selected to conduct research in the microgravity environment of the International Space Station (ISS). The MSRF consists of modular autonomous Materials Science Research Racks (MSRR's). The initial MSRF concept consists of three Materials Science Research Racks (MSRR-1, MSRR-2, and MSRR-3) which will be developed for a phased deployment beginning on Utilization Flight 3. Each MSRR is a stand-alone autonomous rack and will be comprised of either on-orbit replaceable Experiment Modules, Module Inserts, investigation unique apparatus, or multi-user generic processing apparatus Each MSRR will support a wide variety of scientific investigations.
Author
Microgravity; Research Facilities; Materials; Materials Science; Space Laboratories; Research and Development

19990106247 NASA Marshall Space Flight Center, Huntsville, AL USA
Biotechnology Science Experiments on Mir
Kroes, Roger L., NASA Marshall Space Flight Center, USA; 1999; In English; Microgravity Science and Space Processing, 11-14

Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

This paper describes the microgravity biotechnology experiments carried out on the Shuttle/Mir program. Four experiments investigated the growth of protein crystals, and three investigated cellular growth. Many hundreds of protein samples were processed using four different techniques. The objective of these experiments was to determine optimum conditions for the growth of very high quality single crystals to be used for structure determination. The Biotechnology System (BTS) was used to process the three cell growth investigations. The samples processed by these experiments were: bovine chondrocytes, human renal epithelial cells, and human breast cancer cells and endothelial cells. The objective was to determine the unique properties of cell aggregates produced in the microgravity environment.

Author

Biotechnology; Microgravity; Experimentation; Protein Crystal Growth; Gravitational Effects

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ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

19990100971 National Renewable Energy Lab., Golden, CO USA

Ohio's First Ethanol-Fueled Light-Duty Fleet: Final Study Results

Poole, Lauren, National Renewable Energy Lab., USA; Howard, Rene P., National Renewable Energy Lab., USA; Dec. 31, 1998; 379p; In English

Report No.(s): DE00-005830; NREL/BR-540-25238; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In 1996, the State of Ohio established a project to demonstrate the use of an ethanol blend transportation fuel in flexible-fuel vehicles. This report presents the data collection and analysis from this project, with particular focus on vehicle performance, cost of operation and limited emissions testing.

NTIS

Automobiles; Ethyl Alcohol; Fuels

19990101862 National Renewable Energy Lab., Golden, CO USA

Advisor 2.0: A Second-Generation Advanced Vehicle Simulator for Systems Analysis

Markel, A., National Renewable Energy Lab., USA; Bharathan, D., National Renewable Energy Lab., USA; Wipke, K., National Renewable Energy Lab., USA; Cuddy, M., National Renewable Energy Lab., USA; Burch, S., National Renewable Energy Lab., USA; Mar. 23, 1999; 379p; In English

Report No.(s): DE00-005023; NREL/TP-540-25928; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The National Renewable Energy Laboratory has recently publicly released its second-generation advanced called ADVISOR 2.0. This software program was initially developed four years ago, and after several years of in-house usage and evolution, the tool is now available to the public through a new vehicle systems analysis World Wide Web page. ADVISOR has been applied to many different systems analysis problems, such as helping to develop the SAE J1711 test procedure for hybrid vehicles and helping to evaluate new technologies as part of the Partnership for a New Generation of Vehicles (PNGV) technology selection process. The model has been and will continue to be benchmarked and validated with other models and with real vehicle test data. After two months of being available on the Web, more than 100 users have downloaded ADVISOR. ADVISOR 2.0 has many new features, including an easy-to-use graphical user interface, a detailed exhaust aftertreatment thermal model, and complete browser-based documentation. Future work will include adding to the library of components available in ADVISOR, including optimization functionality, and linking with a more detailed fuel cell model.

NTIS

Computerized Simulation; Systems Analysis; Applications Programs (Computers); Vehicles

19990101874 Alabama Univ., Huntsville, AL USA

Experimental Equipment Design and Fabrication Study for Delta-G Experiment *Final Report*

1997; 6p; In English

Contract(s)/Grant(s): NASA Order H-12588

Report No.(s): UAH-97-422; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Research Machine Shop at UAH did not develop any new technology in the performance of the following tasks. All tasks were performed as specified.UAH RMS shall design and fabricate a "poor" model of a silicon-carbide high-temperature crucible with dimensions of 8 inches in diameter and 4 inches high-temperature crucible for pouring liquid ceramic materials at 1200 C into molds from heating ovens. The crucible shall also be designed with a manipulation fixture to facilitate holding and pouring of the heated liquid material. UAH RMS shall investigate the availability of 400 Hz, high-current (65 volts @ 100 amperes) power systems for use in high-speed rotating disk experiments, UAH RMS shall investigate, develop a methodology, and experiment on the application of filament-wound carbon fibers to the periphery of ceramic superconductors to withstand high levels of rotational g-forces. UAH RMS shall provide analytical data to verify the resulting improved disc with carbon composite fibers.
Derived from text
Design Analysis; Fabrication; Experimentation; Silicon Carbides; Fixtures; Carbon Fibers

19990102620 NASA Marshall Space Flight Center, Huntsville, AL USA
Mechanical Property Analysis in the Retracted Pin-Tool (RPT) Region of Friction Stir Welded (FSW) Aluminum Lithium 2195
Ding, R. Jeffrey, NASA Marshall Space Flight Center, USA; Oelgoetz, Peter A., Boeing North America, Inc., USA; 1999; 1p; In English; Friction Stir Welding, 15-16 Jun. 1999, Thousand Oaks, CA, USA
Contract(s)/Grant(s): NAS8-98201; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
The "Auto-Adjustable Pin Tool for Friction Stir Welding", was developed at The Marshall Space Flight Center to address process deficiencies unique to the FSW process. The auto-adjustable pin tool, also called the retractable pin-tool (R.PT) automatically withdraws the welding probe of the pin-tool into the pin-tool's shoulder. The primary function of the auto-adjustable pin-tool is to allow for keyhole closeout, necessary for circumferential welding and localized weld repair, and, automated pin-length adjustment for the welding of tapered material thickness. An overview of the RPT hardware is presented. The paper follows with studies conducted using the RPT. The RPT was used to simulate two capabilities; welding tapered material thickness and closing out the keyhole in a circumferential weld. The retracted pin-tool regions in aluminum- lithium 2195 friction stir weldments were studied through mechanical property testing and metallurgical sectioning. Correlation's can be =de between retractable pin-tool programmed parameters, process parameters, microstructure, and resulting weld quality.
Author
Mechanical Properties; Pins; Aluminum; Lithium; Welded Joints; Friction Welding; Weld Strength

19990102966 Defence Evaluation Research Agency, Malvern, UK
The Systems Engineering Process Model
Brook, Peter, Defence Evaluation Research Agency, UK; Arnold, Stuart, Defence Evaluation Research Agency, UK; The Systems Engineering Framework: Managing and Integrating Complex Projects: Proceedings; 1999, pp. 2.1 - 2.11; In English; See also 19990102965; Copyright; Avail: Issuing Activity, Hardcopy
This paper describes the importance of processes to the practice of systems engineering. They are the pivot for the application of human expertise to the engineering of systems, and facilitate the application of methods and tools. In order for the profession of systems engineering to apply itself across projects, and for organisations to cooperate in large engineering ventures, a degree of standardisation is essential. There have been many moves towards process standardisation, starting in the late 1960's. The most recent to appear, still in draft form, is ISO 15288. This puts systems engineering into the very broadest context of project management and organisational processes, and shows promise of creating a robust underlying model capable of expressing the relationships between them all. Success in this venture could enable more flexible and open practice of systems engineering across project and organisational boundaries, as well as having implications for the professions.
Author
Systems Engineering; Project Management; Models

19990103061 National Renewable Energy Lab., Golden, CO USA
Cummins Engine Company B5.9 Propane Engine Development, Certification, and Demonstration Project
ADEPT Group, I., National Renewable Energy Lab., USA; Dec. 18, 1998; 46p; In English
Report No.(s): DE00-006898; NREL/SR-540-25114; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
The objective of this project was to successfuly develop and certify an LPG-dedicated medium-duty original equipment manufacturer (OEM) engine that could be put into production. The engine was launched into production in 1994, and more than 800 B5.9G engines are now in service in the USA and abroad. This engine is now offered by more than 30 bus and truck OEMs.
NTIS
Internal Combustion Engines; Propane; Engine Design; Fuels

19990103122 National Geodetic Survey, Silver Spring, MD USA

National Height Modernization Study: Report to Congress

Jun. 1998; 186p; In English

Report No.(s): PB99-155533; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This document was prepared in response to the direction contained in House Report 105-207 (to accompany H.R. 2267 - Departments of Commerce, Justice, and State, the Judiciary, and Related Agencies Appropriations Bill, Fiscal Year 1998) that the National Geodetic Survey 'conduct a National Height Modernization Study to demonstrate the effectiveness of this work in California and in western North Carolina. The Committee expects the NGS to conduct this study in consultation with state and local governments and the private sector.' The results of the study, as abstracted by this Executive Summary, present not only a compelling argument for the need to modernize the vertical component of the National Spatial Reference System, but also demonstrate how the Global Positioning System can be used to accomplish the modernization effort with significant cost savings. NTIS

Congressional Reports; Geodetic Surveys; Height

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COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications. For related information see also 04 Aircraft Communications and Navigation and 17 Space Communications, Spacecraft Communications, Command and Tracking. For search and rescue see 03 Air Transportation and Safety, and 16 Space Transportation.

19990100867 NASA Marshall Space Flight Center, Huntsville, AL USA

Interference of Backscatter from Two Droplets in a Focused Continuous Wave CO2 Doppler Lidar Beam

Jarzembski, Maurice A., NASA Marshall Space Flight Center, USA; Srivastava, Vandana, Universities Space Research Association, USA; 1998; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Using a focused continuous wave CO2 Doppler lidar at wavelength 9.1 microns the interference of the superposition of backscatter from two approx. 14.12 microns diameter silicone oil droplets in the lidar beam was observed. This interference results in a single backscatter pulse from the two droplets with a distinct periodic structure. The interference is due to the phase difference in backscatter from the two droplets while they are traversing the lidar beam because they are moving at different speeds and, thus, the droplet separation is not constant. The complete cycle of interference, with periodicity of 2(Pi), gives excellent agreement between measurements and lidar theory.

Author

Backscattering; Carbon Dioxide; Infrared Radar; Silicones; Oils

19990102862 NASA Marshall Space Flight Center, Huntsville, AL USA

Large-Scale Sakharov Condition

Noever, David A., NASA Marshall Space Flight Center, USA; Bremner, Christopher, NASA Marshall Space Flight Center, USA; 1999; In English; 35th; Joint Propulsion, 21 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recent far-reaching theoretical results have used the quantum vacuum noise as a fundamental electromagnetic radiation field to derive a frequency (w) -dependent version of Newton's gravitational coupling term, G(w). This paper reconciles the cutoff frequency with the observed cosmological constant, then briefly puts forward a realizable laboratory test case in the 10-100 Mhz frequency range. One analogy is drawn between the classical vacuum energy experiments with attraction between two closely spaced plates (Casimir cavity) and the arbitrarily dense material boundaries possible in Bose condensates, such as irradiation at Mhz frequencies of superfluid helium or superconductors.

Author

Condensates; Electromagnetic Radiation; Superfluidity; Quantum Theory

19990103034 Ohio State Univ., Columbus, OH USA

Design Issues for Traffic Management for the ATM UBR + Service for TCP Over Satellite Networks *Final Report*

Jain, Raj, Ohio State Univ., USA; July 1999; 216p; In English

Contract(s)/Grant(s): NAS3-97198; RTOP 650-32-5A

Report No.(s): NASA/CR-1999-209158; E-11718; NAS 1.26:209158; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This project was a comprehensive research program for developing techniques for improving the performance of Internet protocols over Asynchronous Transfer Mode (ATM) based satellite networks. Among the service categories provided by ATM networks, the most commonly used category for data traffic is the unspecified bit rate (UBR) service. UBR allows sources to send data into the network without any feedback control. The project resulted in the numerous ATM Forum contributions and papers.

Author

Research; Procedures; Asynchronous Transfer Mode; Satellite Networks

19990103123 National Center for Atmospheric Research, Boulder, CO USA

First Moments of the Variance- and Cross-Spectra of Standard and Interferometric Clear-Air Doppler-Radar Signals

Muschinski, A.; May 1998; 118p; In English

Report No.(s): PB99-162612; NCAR/TN-441-STR; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This technical note was prepared during the author's year-long research stay at NCAR's Atmospheric Technology Division (ATD). It is a translated, revised and slightly extended version of the author's habilitation thesis 'Die ersten Moemente der Varianz- and Kreuzspektren der Signale von konventionellen und interferometrischen Clear-air Doppler-Radars' (in German), which has been also accomplished during the stay at NCAR. This work was motivated by NCAR's and the author's interest to understand in some more detail effects of inhomogeneity and anisotropy of refractive-index irregularities on the signals measured with NCAR's MAPR radar system and other standard and interferometric atmospheric Doppler radars.

NTIS

Doppler Radar; Meteorological Radar; Radar Signatures; Radar Detection; Spectra; Variance (Statistics); Interferometry

19990103762 Physics and Electronics Lab. TNO, The Hague, Netherlands

Transient Electromagnetic Coupling Analysis for HPM Problems by Using the Finite Difference Time Domain Method

vanLeersum, B. J. A. M., Physics and Electronics Lab. TNO, Netherlands; March 1998; 47p; In English

Contract(s)/Grant(s): A94/KL/674; TNO Proj. 24356

Report No.(s): TD96-0362; FEL-96-A161; Copyright; Avail: Issuing Activity, Hardcopy

The research presented in this report is a part of the High Power microwaves (HPM) project. One of the goals of this project is to analyse the interaction between the HPM electromagnetic power and an object. From this analysis it should be apparent what the amount of electromagnetic energy is. that couples into the object. At TNO-FEL several computer codes to solve EM-interaction problems are present and instantly improved and enhanced. One of these codes uses a local method, known as the Finite Difference Time Domain (FDTD) method. The Finite Difference Time Domain technique is a computational method that calculates the temporal evolution of the electromagnetic field within a region of space by stepping through time. One of the merits of FDTD is the capability of evaluating a wide range of frequencies in just one run. Therefore, a time domain excitation that contains a wide frequency range is used. An existing FDTD-code of is used as a starting point for the HPM-research presented in this report. The existing code mainly aimed at calculating the bistatic Radar Cross Section (RCS) of an object. RCS calculations are carried out with a steady state analysis, i.e. the excitation is harmonic and contains just one frequency component. A transient analysis is implemented in the code. The time function of the excitation is rather non-periodical and mostly has a kind of Gaussian shaped pulse. Applying a Fourier transform of the time domain output gives the frequency behaviour of the object object under consideration Generally. when transient analysis is carried out. the FDTD calculations are followed by an FFT routine in order to transform time domain data into frequency domain The bandwidth and the resolution of the spectrum obtained by a general FFT routine is directly dependent on the number of timesteps for which the FDTD calculations are carried out, as well as the size of one timestep (Delta)t. Both parameters are important for the FDTD algorithm as well as for the FFT routine. Another new feature of the code is the capability of the usage of the scattered field formulation instead of the total field formulation Instead of the calculation of the physically present total field, the scattered field is calculated. The scattered field is the total field minus the incident field The incident field is determined analytically and generally represents an plane wave.

Author

Computer Programs; Electromagnetic Coupling; Research; Electromagnetic Fields; Time Domain Analysis; Microwaves; Finite Difference Time Domain Method

19990103973 National Telecommunications and Information Administration, Inst. for Telecommunication Sciences, Boulder, CO USA

Broadband Spectrum Survey at San Francisco, California May-June 1995

Sanders, F. H.; Ramsey, B. J.; Lawrence, V. S.; Jul. 1999; 156p; In English

Report No.(s): PB99-164774; NTIA-99-367; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy

The National Telecommunications and Information Administration (NTIA) is responsible for managing the Federal Government's use of the radio spectrum. NTIA funds the Institute for Telecommunication Sciences (ITS) radio spectrum measurement system to collect data for spectrum utilization assessments. This report details such a data collection effort spanning all of the spectrum from 197 MHz to 19.7 GHz in the metropolitan area of San Francisco, California, during May and June 1995.
NTIS

Broadband; Radio Spectra; Telecommunication; Data Acquisition; Radio Communication; Land Mobile Satellite Service

19990104274 NASA Langley Research Center, Hampton, VA USA

Signal Prediction With Input Identification

Juang, Jer–Nan, NASA Langley Research Center, USA; Chen, Ya–Chin, Institute for Computer Applications in Science and Engineering, USA; October 1999; 33p; In English

Contract(s)/Grant(s): NAS1-97046; NAS1-19480; RTOP 632-10-14-04

Report No.(s): NASA/TM-1999-209705; NAS 1.15:209705; L-17889; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A novel coding technique is presented for signal prediction with applications including speech coding, system identification, and estimation of input excitation. The approach is based on the blind equalization method for speech signal processing in conjunction with the geometric subspace projection theory to formulate the basic prediction equation. The speech-coding problem is often divided into two parts, a linear prediction model and excitation input. The parameter coefficients of the linear predictor and the input excitation are solved simultaneously and recursively by a conventional recursive least-squares algorithm. The excitation input is computed by coding all possible outcomes into a binary codebook. The coefficients of the linear predictor and excitation, and the index of the codebook can then be used to represent the signal. In addition, a variable-frame concept is proposed to block the same excitation signal in sequence in order to reduce the storage size and increase the transmission rate. The results of this work can be easily extended to the problem of disturbance identification. The basic principles are outlined in this report and differences from other existing methods are discussed. Simulations are included to demonstrate the proposed method.
Author

System Identification; Signal Processing; Mathematical Models; Linear Prediction; Coding

19990104601 Air Force Academy, CO USA

Global Broadcast Service An Assessment of Potential Military-Commercial Integration

Tempia, Frank N.; Apr. 01, 1999; 48p; In English

Report No.(s): AD-A367202; AU/AWC/98-234/1998-04; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The Global Broadcast System Service (GBS) is a satellite communications system, which upon acquisition and implementation, will provide a high-speed, one-way data communications broadcast capability, that is, high-volume information transmission worldwide directly to in-theater warfighters The issue is to determine whether to lease bandwidth or time on commercial satellites or developing and building military satellites is the most effective and efficient approach to implement such a system as GBS. This paper first will describe briefly the technology employed in satellite direct broadcast systems such as GBS and DirecPC and the communications requirements these systems satisfy. It further presents a moderately detailed technical description of GBS in order to make comparisons and demonstrate similarities with commercial satellite direct broadcast systems. It then discusses the benefits and accompanying risks and challenges associated with the integration of GBS into commercial direct broadcast systems. Finally the paper will assess the potential for the military-commercial integration of GBS with another commercial direct broadcast systems.
DTIC

Broadcasting; Satellite Communication

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry. For related information see also 60 Computer Operations and Hardware and 76 Solid-State Physics.

19990100608 Los Alamos National Lab., NM USA
Radiation sources working group summary
Fazio, M. V.; Dec. 31, 1998; 11p; In English; 8th; Workshop on Advanced Accelerator Concepts
Report No.(s): DE99-002554; LA-UR-98-3983; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
     The Radiation Sources Working Group addressed advanced concepts for the generation of RF energy to power advanced accelerators. The focus of the working group included advanced sources and technologies above 17 GHz. The topics discussed included RF sources above 17 GHz, pulse compression techniques to achieve extreme peak power levels, components technology, technology limitations and physical limits, and other advanced concepts. RF sources included gyroklystrons, magnicons, free-electron masers, two beam accelerators, and gyroharmonic and traveling wave devices. Technology components discussed included advanced cathodes and electron guns, high temperature superconductors for producing magnetic fields, RF breakdown physics and mitigation, and phenomena that impact source design such as fatigue in resonant structures due to RF heating. New approaches for RF source diagnostics located internal to the source were discussed for detecting plasma and beam phenomena existing in high energy density electrodynamic systems in order to help elucidate the reasons for performance limitations.
NTIS
Radiation Sources; Electron Sources; Radio Frequencies; Particle Accelerators; Electron Beams; Free Electrons; Electron Guns; Plasma Guns

19990100611 Los Alamos National Lab., NM USA
High temperature superconducting current lead test facility with heat pipe intercepts
Blumenfeld, P. E.; Prenger, C.; Roth, E. W.; Stewart, J. A.; Dec. 31, 1998; 4p; In English; Applied superconductivity conference
Report No.(s): DE99-002551; LA-UR-98-4051; No Copyright; Avail: Department of Energy Information Bridge, Microfiche
     A high temperature superconducting (HTS) current lead test facility using heat pipe thermal intercepts is under development at the Superconducting Technology Center at Los Alamos National Laboratory. The facility can be configured for tests at currents up to 1,000 A. Mechanical cryocoolers provide refrigeration to the leads. Electrical isolation is maintained by intercepting thermal energy from the leads through cryogenic heat pipes. HST lead warm end temperature is variable from 65 K to over 90 K by controlling heat pipe evaporator temperature. Cold end temperature is variable up to 30 K. Performance predictions in terms of heat pipe evaporator temperature as a function of lead current are presented for the initial facility configuration, which supports testing up to 200 A. Measurements are to include temperature and voltage gradient in the conventional and HTS lead sections, temperature and heat transfer rate in the heat pipes. as well as optimum and off-optimum performance of the conventional lead sections.
NTIS
Cryogenics; Cryogenic Cooling; Cooling Systems; Superconducting Devices; High Temperature Superconductors; Superconductivity

19990100628 Los Alamos National Lab., NM USA
Capacitance extraction from complex 3D interconnect structures
Cartwright, D.; Csanak, G.; George, D.; Walker, R.; Kuprat, A.; Dec. 31, 1999; 4p; In English; MSM 1999 conference
Report No.(s): DE99-002724; LA-UR-99-888; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
     A new tool has been developed for calculating the capacitance matrix for complex 3D interconnect structures involving multiple layers of irregularly shaped interconnect, imbedded in different dielectric materials. This method utilizes a new 3D adaptive unstructured grid capability, and a linear finite element algorithm. The capacitance is determined from the minimum in the total system energy as the nodes are varied to minimize the error in the electric field in the dielectric(s).
NTIS
Extraction; Capacitance; Joining

19990100916 NASA Marshall Space Flight Center, Huntsville, AL USA
Analyses of Transistor Punchthrough Failures
Nicolas, David P., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; Alabama Imaging and Microscopy Society, 29-30 Apr. 1999, Birmingham, AL, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The failure of two transistors in the Altitude Switch Assembly for the Solid Rocket Booster followed by two additional failures a year later presented a challenge to failure analysts. These devices had successfully worked for many years on numerous missions. There was no history of failures with this type of device. Extensive checks of the test procedures gave no indication for a source of the cause. The devices were manufactured more than twenty years ago and failure information on this lot date code was not readily available. External visual exam, radiography, PEID, and leak testing were performed with nominal results Electrical testing indicated nearly identical base-emitter and base-collector characteristics (both forward and reverse) with a low resistance short emitter to collector. These characteristics are indicative of a classic failure mechanism called punchthrough. In failure analysis punchthrough refers to an condition where a relatively low voltage pulse causes the device to conduct very hard producing localized areas of thermal runaway or "hot spots". At one or more of these hot spots, the excessive currents melt the silicon. Heavily doped emitter material diffuses through the base region to the collector forming a diffusion pipe shorting the emitter to base to collector. Upon cooling, an alloy junction forms between the pipe and the base region. Generally, the hot spot (punch-through site) is under the bond and no surface artifact is visible. The devices were delidded and the internal structures were examined microscopically. The gold emitter lead was melted on one device, but others had anomalies in the metallization around the in-tact emitter bonds. The SEM examination confirmed some anomalies to be cosmetic defects while other anomalies were artifacts of the punchthrough site. Subsequent to these analyses, the contractor determined that some irregular testing procedures occurred at the time of the failures heretofore unreported. These testing irregularities involved the use of a breakout box and were the likely cause of the failures. There was no evidence to suggest a generic failure mechanism was responsible for the failure of these transistors.
Author
Leakage; Transistors; Failure Analysis; Switches; Anomalies

19990102216 NASA Marshall Space Flight Center, Huntsville, AL USA
High Efficiency Binary Blazed Grating Waveguide Couplers
Watson, Michael D., NASA Marshall Space Flight Center, USA; Abushagur, Mustafa A. G., Alabama Univ., USA; Ashley, Paul R., Army Missile Command, USA; Cole, Helen, NASA Marshall Space Flight Center, USA; [1998]; In English; Diffractive Optics and Micro Optics, Kailua-Kona,HI, USA; Sponsored by Optical Society of America, USA
Contract(s)/Grant(s): RTOP 274-62-00-R04; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
Binary blazed gratings are investigated as highly efficient waveguide couplers. Equations are derived for the design of efficient binary blazed grating waveguide couplers. The design approach relates waveguide blazed grating equations to Artificial Index Grating (AIG) equations to emulate a blazed grating. Using these relationships, binary blazed gratings can be accurately designed to output a single mode at a desired output angle. Binary blazed grating couplers can achieve single mode cladding output without substrate" radiation output modes. Much higher output angles can be achieved than with rectangular grating couplers. The use of the AIG grating structure simplifies fabrication approaches. Waveguide couplers were designed using these equations.
Author
Blazars; Research; Couplers; Optical Waveguides

19990102615 NASA Marshall Space Flight Center, Huntsville, AL USA
Fabrication of Large YBCO Superconducting Disks
Koczor, Ronald J., NASA Marshall Space Flight Center, USA; Noever, David A., NASA Marshall Space Flight Center, USA; Robertson, Glen A., NASA Marshall Space Flight Center, USA; 1999; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
We have undertaken fabrication of large bulk items to develop a repeatable process and to provide test articles in laboratory experiments investigating reported coupling of electromagnetic fields with the local gravity field in the presence of rotating superconducting disks. A successful process was developed which resulted in fabrication of 30 cm diameter annular disks. The disks were fabricated of the superconductor YBa2Cu3O(7-x). Various material parameters of the disks were measured.
Author
Fabrication; YBCO Superconductors; Superconductors (Materials); Superconductivity; Rotating Disks

19990102910 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Shock Testing of: Two Switches, Type L1914 and L1920; An Emergency Switch, Type 704.064.2; A rotary Switch, Type QM40; Two wall Sockets, Type L1957 and L1960
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Jul. 30, 1999; 34p; In English; Original contains color illustrations
Contract(s)/Grant(s): TNO Proj. 006.93292/01.01; A99/KM/102
Report No.(s): TD99-0094; TNO-99-CMC-R042; Copyright; Avail: Issuing Activity, Hardcopy

Shock tests have been performed on wall sockets and switches. The emergency switch did not meet the requirements due to separation of the contact block from the push button. Contact rumble was established with the rotary and emergency switch.
Author

Shock Tests; Performance Tests; Switches

19990103076 Los Alamos National Lab., Center for Materials Science, NM USA

Electronic transport in unconventional superconductors

Graf, M. J.; Dec. 31, 1998; 23p; In English

Report No.(s): DE99-002560; LA-UR-98-4082; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The author investigates the electron transport coefficients in unconventional superconductors at low temperatures, where charge and heat transport are dominated by electron scattering from random lattice defects. He discusses the features of the pairing symmetry, Fermi surface, and excitation spectrum which are reflected in the low temperature heat transport. For temperatures $(kappa)(sub B)T$ (approx-lt) $(gamma)$ (much-lt) $(Delta)(sub 0)$, where $(gamma)$ is the bandwidth of impurity induced Andreev states, certain eigenvalues become universal, i.e., independent of the impurity concentration and phase shift. Deep in the superconducting phase $((kappa)(sub B)T$ (approx-lt) $(gamma))$ the Wiedemann-Franz law, with Sommerfeld's value of the Lorenz number, is recovered. He compares the results for theoretical models of unconventional superconductivity in high-(Tc) and heavy fermion superconductors with experiment. The findings show that impurities are a sensitive probe of the low-energy excitation spectrum, and that the zero-temperature limit of the transport coefficients provides an important test of the order parameter symmetry.
NTIS

Electron Transfer; Thermal Conductivity; Heavy Fermion Superconductors

19990104365 NASA Marshall Space Flight Center, Huntsville, AL USA

Test Status for Proposed Coupling of a Gravitational Force to Extreme Type II YBCO Ceramic Superconductors

Noever, David, NASA Marshall Space Flight Center, USA; Li, Ning, NASA Marshall Space Flight Center, USA; Robertson, Tony, NASA Marshall Space Flight Center, USA; Koczor, Ron, NASA Marshall Space Flight Center, USA; Brantley, Whitt, NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

As a Bose condensate, superconductors provide novel conditions for revisiting previously proposed couplings between electromagnetism and gravity. Strong variations in Cooper pair electron density, large conductivity and low magnetic permeability define superconductive and degenerate condensates without the traditional density limits imposed by the Fermi energy (about 10-6 g/cu cm). Recent experiments have reported anomalous weight loss for a test mass suspended above a rotating Type II, YBCO superconductor, with the percentage change (0.05-2.1%) independent of the test mass' chemical composition and diamagnetic properties. A variation of 5 parts per 10(exp 4) was reported above a stationary (non-rotating) superconductor. In the present experiments reported using a sensitive gravimeter (resolution is less than 10(exp -9) unit gravity or variation of 10(exp -6) cm/sq s in accelerations), bulk YBCO superconductors were stably levitated in a DC magnetic field (0.6 Tesla) subject to lateral AC fields (60 Gauss at 60 Hz) and rotation. With magnetic shielding, thermal control and buoyancy compensation, changes in acceleration were measured to be less than 2 parts in 10(exp 8) of the normal gravitational acceleration. This result puts new limits on the strength and range of the proposed coupling between high-Tc superconductors and gravity. Latest test results will be reported, along with status for future improvements and prospects.
Author

Electromagnetism; Gravitation; YBCO Superconductors

19990105724 National Inst. of Standards and Technology, Statistical Engineering Div., Boulder, CO USA

Empirical Modeling of Electromagnetic Accoustic Transducer Data

Coakley, K. J.; Clark, A. V.; Hehman, C. S.; Aug. 1999; 24p

Report No.(s): PB99-168965; NISTIR-5087; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We characterize the observed phase and amplitude of acoustic birefringence data collected with an electromagnetic acoustic transducer (EMAT). Our characterization models are extended versions of an idealized model for acoustic birefringence. In the extended models, angle-dependent terms account for observed variability in phase and amplitude, which is not predicted by the idealized theory. Possible sources of this extra variability include material inhomogeneity and angle-dependent sensor gain. The adjustable parameters in the model are determined by minimizing the sum of the squared phase residuals plus the sum of the squared amplitude residuals. to facilitate convergence, we determine the model parameters by fitting the extended models sequentially according to model complexity. Ten experimental data sets were collected from the same sample. We estimate the mean value of each model parameter and its associated standard error. For each extended model, we estimate the mean phase delay between

the fast and slow modes. We also estimate the mean rotation angle of the pure-mode polarization directions (relative to a reference coordinate system in the specimen). From run to run, we observed phase data drift.

NTIS

Ultrasonic Tests; Stress Analysis; Numerical Analysis; Sound Transducers; Electroacoustic Transducers; Sound Waves

19990105887 Sandia National Labs., Albuquerque, NM USA

Wet Oxidation of High-Al-Content III-V Semiconductors: Important Materials Considerations for Device Applications

Ashby, C. I. H.; May 19, 1999; 5p; In English; 45th; Spring 1999 Materials Research Meeting 45th International Symposium of the American Vacuum Society; San Francisco, CA; 04/05/1999, 5 Apr. 1999, San Francisco, CA, USA; Sponsored by Materials Research Society, USA

Report No.(s): DE00-007260; SAND99-1273C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

   Wet oxidation of high-Al-content AlGaAs semiconductor layers in vertical cavity surface emitting lasers (VCSELS) has produced devices with record low threshold currents and voltages and with wall-plug efficiencies greater than 50%. Wet oxidation of buried AlGaAs layers has been employed to reduce the problems associated with substrate current leakage in GaAs-on- insulator (GOI) MESFETS. Wet oxidation of high-Al-content AlGaAs semiconductor layers in vertical cavity surface emitting lasers (VCSELS) has produced devices with record low threshold currents and voltages and with wall-plug efficiencies greater than 50%. Wet oxidation of buried AlGaAs layers has been employed to reduce the problems associated with substrate current leakage in GaAs-on- insulator (GOI) MESFETS. Wet oxidation has also been considered as a route to the long-sought goal of a IH-V MIS technology. to continue improving device designs for even higher performance and to establish a truly manufacturable technology based on wet oxidation, the effect of oxidation of a given layer on the properties of the entire device structure must be understood. The oxidation of a given layer can strongly affect the electrical and chemical properties of adjacent layers. Many of these effects are derived from the production of large amounts of elemental As during the oxidation reaction, the resultant generation of point defects, and the diffusion of these defects into adjacent regions. This can modify the chemical and electrical properties of these regions in ways that can impact device design, fabrication, and performance. Current understanding of the problem is discussed here.

NTIS

Aluminum Gallium Arsenides; Electrical Properties; Fabrication; Gallium Arsenides; Insulators; Semiconductors (Materials); Oxidation-Reduction Reactions

19990106245 NASA Marshall Space Flight Center, Huntsville, AL USA

Integrating Partial Polarization into a Metal-Ferroelectric-Semiconductor Field Effect Transistor Model

MacLeod, Todd C., NASA Marshall Space Flight Center, USA; Ho, Fat Duen, Alabama Univ., USA; Jan. 01, 1999; In English; Integrated Ferroelectrics, 7 Mar. 1999, Colorado Springs, CO, USA; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

   The ferroelectric channel in a Metal-Ferroelectric-Semiconductor Field Effect Transistor (MFSFET) can partially change its polarization when the gate voltage near the polarization threshold voltage. This causes the MFSFET Drain current to change with repeated pulses of the same gate voltage near the polarization threshold voltage. A previously developed model [11, based on the Fermi-Dirac function, assumed that for a given gate voltage and channel polarization, a sin-le Drain current value would be generated. A study has been done to characterize the effects of partial polarization on the Drain current of a MFSFET. These effects have been described mathematically and these equations have been incorporated into a more comprehensive mathematical model of the MFSFET. The model takes into account the hysteresis nature of the MFSFET and the time dependent decay as well as the effects of partial polarization. This model defines the Drain current based on calculating the degree of polarization from previous gate pulses, the present Gate voltage, and the amount of time since the last Gate volta-e pulse.

Author

Integrated Circuits; Polarization (Charge Separation); Field Effect Transistors; Ferroelectricity

19990106250 California Univ., San Diego, La Jolla, CA USA

Optoelectronic Systems for Space-Variant Signal and Image Processing *Final Report, Jul. 1997 - Jul. 1998*

Fainman, Yeshaiahu; Shames, Paul E.; Oct. 1998; 57p; In English

Contract(s)/Grant(s): F30602-97-C-0279; DARPA ORDER-B667

Report No.(s): AD-A358424; AFRL-SN-RS-TR-1998-196; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

   This final report outlines the past year's study of an Optoelectronic system for space variant image and signal processing.

Derived from text

Image Processing; Image Analysis; Imaging Techniques; Images; Pattern Recognition; Signal Processing; Electro-Optics

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling. For related information see also 02 Aerodynamics and 77 Thermodynamics and Statistical Physics.

19990099733 NASA Marshall Space Flight Center, Huntsville, AL USA
Control of Meridional Flow in Circular Cylinders by a Travelling Axial Magnetic Field
Mazuruk, K., Universities Space Research Association, USA; Ramachandran, N., Universities Space Research Association, USA; Volz, M. P., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 37th; Aerospace Sciences Meeting and Exhibit, 11-14 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity, Hardcopy

Convective flow in a Bridgman or float zone configuration significantly affects the interface shape and segregation phenomena. While the primary causative factor for this flow is buoyancy induced convection in an enclosed Bridgman melt, the presence of a free surface gives rise to surface tension driven flows in the floating zone processing of melts. It is of interest to curtail these flows in order to realize near quiescent growth conditions that have shown to result in crystals with good longitudinal and radial homogeneity and thereby of better overall quality. While buoyancy effects can be reduced by careful processing in a low gravity (space) environment, the reduction of Marangoni flows due to surface tension variations is not that straight forward. Attempts have been made with some limited success with the use of external fields to affect the melt thermo-fluid behavior. The use of a static magnetic field that reduces convective contamination through the effects of a non-intrusively induced, dissipative Lorentz force in an electrically conducting melt is one such approach. Experiments have shown that axial fields of the order of 5 Tesla can significantly eliminate convection and yield close to diffusion limited crystal growth conditions. The generation and use of such high magnetic fields require substantial hardware and incur significant costs for its operation. Lately, the use of rotating magnetic fields has been tested in semiconductor crystal growth. The method is fairly well known and commonly used in metal processing but its adaptation to crystal growth of semiconductors is fairly recent. The elegance of the technique rests in its low power requirement (typically 10-20 milli-Tesla at 50-400 Hz) and its efficacy in curtailing deleterious temperature fluctuations in the melt. A rotating magnetic field imposes a rotational force and thereby induces a circulation within the melt that tends to dominate other sporadic convective effects. Thus a known low level of convective flow is introduced into the system. A new novel variation of the Lorentz force mechanism is proposed and investigated in this study. Since one of the desired process conditions in melt crystal growth is the minimization of convective effects, this investigation examines the use of an external field of magnetic origin to counteract existing convective flow within the melt. This is accomplished by utilizing a running or traveling axial magnetic wave in the system. The concept is similar to the use of vibrational means in order to induce streaming flows that oppose buoyant or surface tension driven convection in the system. The rotation direction as well as the magnitude (strength) of this circulation can be easily controlled by external inputs thus affording a direct means of controlling the developing shape of the crystallizing front (interface). The theoretical model of this technique is fully developed and presented in this paper. Results from the solution of the developed governing equations and boundary conditions are also presented. An experimental demonstration of the concept is presented through the suppression of natural convective flow in a mercury column. Implications to crystal growth systems will be fully explored in the final manuscript.
Author
Buoyancy; Circular Cylinders; Convection; Convective Flow; Crystal Growth; Crystallization; Crystals; Magnetic Field Configurations; Magnetic Fields; Magnetostatic Fields; Melts (Crystal Growth); Microgravity Applications

19990100639 NASA Marshall Space Flight Center, Huntsville, AL USA
Mixing Characteristics of Coaxial Injectors at High Gas to Liquid Momentum Ratios
Strakey, P. A., Air Force Research Lab., USA; Talley, D. G., Air Force Research Lab., USA; Hutt, J. J., NASA Marshall Space Flight Center, USA; [1999]; 32p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A study of the spray of a swirl coaxial gas-liquid injector operating at high gas to liquid momentum ratios is reported. Mixing and droplet size characteristics of the swirl injector are also compared to a shear coaxial injector, currently being used in the Space Shuttle Main Engine fuel preburner. The injectors were tested at elevated chamber pressures using water as a LOX simulant and nitrogen and helium as gaseous hydrogen simulants. The elevated chamber pressure allowed for matching of several of the preburner injector conditions including; gas to liquid momentum ratio, density ratio and Mach number. Diagnostic techniques used to characterize the spray included; strobe back-light imaging, laser sheet spray imaging, mechanical patternation, and a phase Doppler interferometry. Results thus far indicate that the radial spreading of the swirl coaxial spray is much less than was reported

in previous studies of swirl injectors operating at atmospheric back-pressure. The swirl coaxial spray does, however, exhibit a smaller overall droplet size which may be interpreted as an increase in local mixing.

Author

Space Shuttle Main Engine; Preburners; Turbine Pumps; Fuel Pumps; Injectors; Cold Flow Tests

19990100659 NASA Langley Research Center, Hampton, VA USA

Numerical Analysis of Convection/Transpiration Cooling

Glass, David E., NASA Langley Research Center, USA; Dilley, Arthur D., FDC/NYMA, Inc., USA; Kelly, H. Neale, Analytical Services and Materials, Inc., USA; [1999]; 12p; In English; 9th; 3rd; International Space Planes and Hypersonic Systems and Technoogies, 1-5 Nov. 1999, Norfolk, VA, Norfolk, VA, USA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): F33657-93-C-2227

Report No.(s): AIAA Paper 99-4911; Copyright Waived; Avail: CASI; A03, Hardcopy; A01, Microfiche

An innovative concept utilizing the natural porosity of refractory-composite materials and hydrogen coolant to provide CONvective and TRANspiration (CONTRAN) cooling and oxidation protection has been numerically studied for surfaces exposed to a high heat flux high temperature environment such as hypersonic vehicle engine combustor walls. A boundary layer code and a porous media finite difference code were utilized to analyze the effect of convection and transpiration cooling on surface heat flux and temperature. The boundary layer code determined that transpiration flow is able to provide blocking of the surface heat flux only if it is above a minimum level due to heat addition from combustion of the hydrogen transpirant. The porous media analysis indicated that cooling of the surface is attained with coolant flow rates that are in the same range as those required for blocking, indicating that a coupled analysis would be beneficial.

Author

Numerical Analysis; Refractory Materials; Hydrogen; Coolants; Convective Heat Transfer; Mass Transfer; Porous Boundary Layer Control; Porosity

19990101891 Newcastle Univ., Dept. of Mechanical Engineering, Newcastle, Australia

Combined Effect of Wall Suction and Riblets on a Low R (theta) Turbulent Boundary Layer

Djenidi, L., Newcastle Univ., Australia; Antonia, R. A., Newcastle Univ., Australia; Hundseid, J., Trondheim Univ., Norway; Krogstad, P. A., Trondheim Univ., Norway; The Aeronautical Journal; Jan. 1998; Volume 102, No. 1011, pp. 53-57; In English; See also 19990101884

Report No.(s): Paper 2346; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A low Reynolds number turbulent boundary layer is subjected to a relatively strong rate of suction, which is applied through a short porous trip. Downstream of the strip, the effectiveness of a riblet surface is assessed by comparison to that of a smooth wall. Measured mean velocity and longitudinal turbulence intensity profiles indicate that the riblets do not hinder the action the suction can have on the flow.

Author

Low Reynolds Number; Riblets; Suction; Turbulent Boundary Layer; Friction Drag; Wind Tunnel Tests

19990102914 Swedish Defence Research Establishment, Div. of Systems and Underwater Technology, Stockholm, Sweden

Low-Frequency Slow-Wave Dispersion Computations by Compound-Matrix Propagation *Dispersionsberaekningar foer Langsamma Agor vid lag Frekvens med Deltamatristeknik*

Ivansson, Sven, Swedish Defence Research Establishment, Sweden; Dec. 1998; 36p; In English

Report No.(s): PB99-172470; FOA-R-98-00921-409-SE; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Slow modes such that the horizontal slowness tends to infinity as the frequency tends to zero exit in certain laterally homogeneous fluid-solid media. These slow P-SV modes for which the horizontal wavenumber tends to zero with the frequency can be characterized by an asymptotic analysis of the dispersion function. It turns out that only certain powers of frequency are possible for the asymptotic increase of the horizontal slowness as the frequency tends to zero: -1/3, -1/2, -3/5, and -2/3. In order to investigate the accuracy of the asymptotic predictions, computations of dispersion curves by propagator techniques are attempted for media composed of homogeneous fluid and solid layers. However, loss of numerical precision by cancellation effects appears for the elements of the solid-layer compound-matrix propagators that are involved. Guided by the asymptotic growth of these compound-matrix elements, cancellation-free expressions are derived for applications to the slow modes at very low frequencies.

NTIS

Matrices (Mathematics); Wave Propagation; Wave Equations; Low Frequencies

19990102928 Kentucky Univ., Dept. of Mechanical Engineering, Lexington, KY USA

Modeling of Flow Transition Using an Intermittency Transport Equation *Final Report*

Suzen, Y. B., Kentucky Univ., USA; Huang, P. G., Kentucky Univ., USA; September 1999; 34p; In English

Contract(s)/Grant(s): NCC3-590; RTOP 522-31-23

Report No.(s): NASA/CR-1999-209313; E-11902; NAS 1.26:209313; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A new transport equation for intermittency factor is proposed to model transitional flows. The intermittent behavior of the transitional flows is incorporated into the computations by modifying the eddy viscosity, mu(sub t), obtainable from a turbulence model, with the intermittency factor, gamma: mu(sub t, sup *) = gamma.mu(sub t). In this paper, Menter's SST model (Menter, 1994) is employed to compute mu(sub t) and other turbulent quantities. The proposed intermittency transport equation can be considered as a blending of two models - Steelant and Dick (1996) and Cho and Chung (1992). The former was proposed for near-wall flows and was designed to reproduce the streamwise variation of the intermittency factor in the transition zone following Dhawan and Narasimha correlation (Dhawan and Narasimha, 1958) and the latter was proposed for free shear flows and was used to provide a realistic cross-stream variation of the intermittency profile. The new model was used to predict the T3 series experiments assembled by Savill (1993a, 1993b) including flows with different freestream turbulence intensities and two pressure-gradient cases. For all test cases good agreements between the computed results and the experimental data are observed.
Author

Intermittency; Transport Theory; Eddy Viscosity; Turbulent Flow; Turbulence Models; Navier-Stokes Equation

19990102975 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Inst. for Propulsion Technology, Cologne, Germany

Doppler Global Velocimetry

Roehle, Ingo, Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Germany; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 4-1 - 4-22; In English; See also 19990102970; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

This text accompanies two lectures about a relatively new planar laser measurement technique which is mostly known under the name Doppler Global Velocimetry (DGV). Doppler Global Velocimetry is an imaging anemometer. Fir.st the text will describe the basic idea of DGV. Next, the DGV system, which was sct up in the Institute of Propulsion Technology will he described in detail as well as the experimental experiences which were gained in practical applications. lt is a system optimized for time averaged three component velocity measurements. The text will also show a variety of applications, a short accuracy analysis of DGV and a comparison between DGV and PIV. by know there are also two other names for DGV used in the recent literature. One is Planar Doppler Velocimetry (PDV), the other one its Global Doppler Velocimetry (GDV). The DGV technique was invented hy H. Komine at Northrop Research Center. J Meyers from NASA Langley was the first scientist picked up this idea and turned it into a usable tool for aerodynamic research. It was also him who named the technique DGV. Therefor the author will stick to this name.
Author

Velocity Measurement; Particle Image Velocimetry; Imaging Techniques; Procedures

19990102977 Rouen Univ., France

Planar Laser Induced Fluorescence for Investigation of Scalars in Turbulent Reacting Flows

Stepowski, D., Rouen Univ., France; Planar Optical Measurement Methods for Gas Turbine Components; September 1999, pp. 6-1 - 6-18; In English; See also 19990102970; Original contains color illustrations; Copyright Waived; Avail: CASI; A03, Hardcopy; A02, Microfiche

The basic principles of Laser Induced Fluorescence are described with progressive presentation of simple and multi-level interaction schemes providing the relationship between the fluorescence signal and the local concentration of the investigated species in the laser field. Essential differences between Laser Induced Fluorescence and flame Chemiluminescence emissions are given. Techniques for imaging in the Planar LIF configuration and procedures for calibration of the fluorescence intensity in absolute concentration values are described. Then, examples of imaging applications are given for instantaneous mapping of OH, CH, O2, and temperature fields in turbulent reacting flows. In spite of uncertainties mainly due to collisional quenching effects, these imaging experiments are useful to ted the interaction processes involved in turbulent combustion especially when several quantities can be simultaneously or conditionally registered.
Author

Scalars; Laser Induced Fluorescence; Turbulent Flow; Transferred Electron Devices; Imaging Techniques; Chemiluminescence

Technical Report of National Aerospace Laboratory. Visualization of Separated Flows over the Circular Cylinder at High Reynolds Numbers

Flow visualization tests have been conducted in the NAL Two-Dimensional Transonic Wind Tunnel to investigate the boundary layer separation over circular-cylinder models at Reynolds number range of 5 x 10(exp 5) and a Mach number of around 0.5. The laminar separation bubbles are observed on the surface around the critical Reynolds number and the cell-like structures are seen along the span. As Reynolds number increases, the laminar bubbles disappear and the flow field becomes more complicated. The ratio of the average cell length to the cylinder diameter is about 0.3 to 1.3 at Reynolds number of 20 x 10(exp 5). Results of the visualization tests show that the separated flow is three-dimensional. The authors have established the liquid crystal technique to visualize boundary layer flows in the blow down wind tunnel.
NTIS
Circular Cylinders; Cylindrical Bodies; Flow Visualization; High Reynolds Number; Boundary Layer Separation; Flow Distribution

Turbulent Diffusivities for Momentum, Heat, Salt and Passive Scalars

A program began ten years ago to build a turbulence model to describe high Reynolds numbers flows. Specifically, the aim was to devise a model that would satisfy two basic conditions: reproduce available turbulence data (laboratory, numerical simulations, etc.) concerning shear driven flows, buoyancy driven flows, 2D turbulence, freely decaying turbulence etc., and yet be manageable so as to be used, for example, in GCM'S. The model was presented in a series of papers that have appeared in Physics of FLuids since 1996. A total of about 80 turbulence statistics were reproduced. The model has no adjustable parameters. The next step was to apply the model to construct the vertical diffusivities K for moment K(sub m), temperature K(sub h), salt K(sub g) and passive scalars K(sub c). First, we took K(sub g) = K(sub h) and tested the model using the Geophysical Fluid Dynamics Laboratory (GFDL) ocean model. The results for the profiles of T and S vs. depth are indistinguishable from those derided using the latest model, the KPP model by the NCAR group. Presently, we are running the same GFDL code relaxing the assumptive K(sub g) = K(sub h). Indeed, the turbulence model yields a salt diffusivity that depends on Ri and R Rho (= Beta Sigma S/Sigma z/Alpha Sigma T/Sigma z) in such a way that K(sub g) may be quite different from K(sub h). Salt fingers and double diffusivity laboratory data are reproduced. Results from the ocean model will be available shortly. Finally, we are trying to derive the horizontal diffusivities with the goal of providing a physically acceptable representation of mesoscale eddies. The recently suggested GMW parameterization has improved several O-GCM results and the goal here is to try to derive/justify it from a turbulence model and/or propose improvements/modifications. Theoretical work is in progress.
Author
Fluid Dynamics; Geophysics; High Reynolds Number; Turbulence Models; Atmospheric General Circulation Models; Turbulence; Ocean Models

Magnetic Field Effect on the Stability of Flow Induced by a Rotating Magnetic Field

A linear stability analysis has been performed for the flow induced by a rotating magnetic field in a cylindrical column filled with electrically conducting fluid. The first transition is time- independent and results in the generation of Taylor vortices. The critical value of the magnetic Taylor number has been examined as a function of the strength of the transverse rotating magnetic field, the strength of an axial static magnetic field, and thermal buoyancy. Increasing the transverse field increases the critical magnetic Taylor number and decreases the aspect ratio of the Taylor vortices at the onset of instability. An increase in the axial magnetic field also increases the critical magnetic Taylor number but increases the aspect ratio of the Taylor vortices. Thermal buoyancy is found to have only a negligible effect on the onset of instability.
Author
Magnetic Fields; Rotation; Flow Stability; Stability Tests; Magnetic Effects

19990103969 James Madison Univ., Dept. of Mathematics, Harrisonburg, VA USA

A Semi-Implicit Method for Internal Boundary Layers in Compressible Flows

Pruett, C. David, James Madison Univ., USA; Computer Methods in Applied Mechanics and Engineering; 1996; ISSN 0045-7825; Volume 137, pp. 379-393; In English

Contract(s)/Grant(s): NAG1-1772; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A semi-implicit boundary-layer method is developed for application to spatially evolving internal boundary layers in compressible fluids. The method circumvents convergence difficulties that may arise with fully implicit marching schemes whenever the mean streamwise velocity profile is inflectional. The method is demonstrated for the special case of the compressible, laminar axisymmetric jet. However, the properties of the scheme make it well suited also to laminar or turbulent free shear layers, wakes and planar jets.

Author

Compressible Fluids; Laminar Flow; Computational Fluid Dynamics; Compressible Boundary Layer

19990104061 Old Dominion Univ., Research Foundation, Norfolk, VA USA

Disturbance Dynamics in Transitional and Turbulent Flows *Final Report, Period ending 1 Nov. 1999*

Grosch, Chester E., Old Dominion Univ., USA; October 1999; 34p; In English

Contract(s)/Grant(s): NAG1-2121

Report No.(s): ODURF-191141; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In order to expand the predictive capability of single-point turbulence closure models to account for the early-stage transition regime, a methodology for the formulation and calibration of model equations for the ensemble-averaged disturbance kinetic energy and energy dissipation rate is presented. First the decay of laminar disturbances and turbulence in mean shear-free flows is studied. In laminar flows, such disturbances are linear superpositions of modes governed by the Orr-Sommerfeld equation. In turbulent flows, disturbances are described through transport equations for representative mean quantities. The link between a description based on a deterministic evolution equation and a probability based mean transport equation is established. Because an uncertainty in initial conditions exists in the laminar as well as the turbulent regime, a probability distribution must be defined even in the laminar case. Using this probability distribution, it is shown that the exponential decay of the linear modes in the laminar regime can be related to a power law decay of both the (ensemble) mean disturbance kinetic energy and the dissipation rate. The evolution of these mean disturbance quantities is then described by transport equations similar to those for the corresponding turbulent decaying flow. Second, homogeneous shear flow, where disturbances can be described by rapid distortion theory (RDT), is studied. The relationship between RDT and linear stability theory is exploited in order to obtain a closed set of modeled equations. The linear disturbance equations are solved directly so that the numerical simulation yields a database from which the closure coefficients in the ensemble-averaged disturbance equations can be determined.

Author

Perturbation Theory; Distortion; Transition Flow; Turbulent Flow; Closure Law; Laminar Flow; Shear Flow

19990104261 General Electric Co., Schenectady, NY USA

Acoustic damping of a pipeline cavity system

Reiss, M.; Mar. 31, 1999; 91p; In English

Report No.(s): DE99-002680; KAPL-P-000216; K-99033; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This investigation addresses the acoustic damping of an open-ended pipeline-cavity system from both theoretical and experimental perspectives. Characterization of the damping involves the quality (Q) factor. Theoretical predictions of Q-factors were derived from first principles for the case of a pipe without a cavity or flow. Equations are provided for the most general case, as well as for limiting cases, using dimensionless representations of viscosity, frequency, wave number and pipe size. These predictions are compared with experimental data to determine the effects of: (1) mean flow; (2) presence of a cavity; and (3) lengths of the pipe segments upstream and downstream of the cavity. Experimental data were acquired using high sensitivity pressure transducers interfaced with a computer incorporating an advanced version of an on-line data acquisition system. For cases without mean flow, the experimental data show values of Q-factors generally lower than theoretical predictions. The presence of mean flow results in a further increase in damping of the system. These findings provide a basis for future flow-tone investigations.

NTIS

Damping; Acoustics; Turbulent Flow; Pipelines; Acoustic Attenuation; Absorbers (Materials); Cavity Flow; Vibration

Comparison of Two-Equation Turbulence Models for Prediction of Heat Transfer on Film-Cooled Turbine Blades
Garg, Vijay K., AYT Corp., USA; Ameri, Ali A., AYT Corp., USA; Numerical Heat Transfer; 1997; Volume 31, Pt. A, pp. 347-371; In English

A three-dimensional Navier-Stokes code has been used to compute the heat transfer coefficient on two film-cooled turbine blades, namely, the VKI rotor with six rows of cooling holes, including three rows on the shower head and the C3X vane with nine rows of holes, including five rows on the shower head. Predictions of heat transfer coefficient at the blade surface using three two-equation turbulence model specifically, Coakley's q-omega model, Chien's k-epsilon model and Wilcox's k-omega model with Menter's modifications, have been compared with the experimental data of Camci and Arts for the VKI rotor, and of Hylton et al. for the C3X vane along with predictions using the Baldwin-Lomar (B-L) model taken from Garg and Gaugler. It is found that for the cases considered here the two equation models predict the blade heat transfer somewhat better than the B-L model except immediately downstream of the film-cooled holes on the suction surface of the VKI rotor, and over most of the suction surface of the C3X vane. However, all two-equation models require 40% more computer core than the B-L model for solution, and while the q-omega and k-epsilon models need 40% more computer time than the B-L model the k-omega model requires at least 65% more time because of the slower rate of convergence. It is found that the heat transfer coefficient exhibit a strong span-wise as well as streamwise variation for both blades and all turbulence models.
Author
Convergence; Heat Transfer; K-Epsilon Turbulence Model; Mathematical Models; Navier-Stokes Equation; Rotors; Turbine Blades; Turbulence Models; Computational Fluid Dynamics; Film Cooling; Airfoils; Compressible Flow; Baldwin-Lomax Turbulence Model

Flow Pattern and Self-Induced Oscillation in a Thin Rectangular Tank with Free Surface
Okamoto, Loji, Tokyo Univ., Japan; Madarame, Haruki, Tokyo Univ., Japan; Fukaya, Masahi, Tokyo Univ., Japan; Journal of the Faculty of Engineering the University of Tokyo. Series B; Sep. 1993; ISSN 0563-7937; Volume 62, No. 2, pp. 123-142; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

It is difficult to numerically simulate flow with a free surface because of the non-linearity of the boundary condition at the free surface. The interaction between the free surface and the flow may cause undesirable phenomena, e.g., gas entrainment and self-induced oscillation. In order to evaluate the interaction, the flow in a thin rectangular tank with a free surface was experimentally investigated. The velocity distributions in the test tank and the shape of the free surface were measured to supply the verification data base for the numerical simulation code. The oscillations caused by the interaction between the flow and the free surface were examined with various test tank geometries, inlet velocities and water levels.
Author (revised)
Tank Geometry; Liquid Sloshing; Self Oscillation; Flow Characteristics; Velocity Distribution; Flow Velocity

Computational Fluid Dynamics Modeling of Submunition Separation from Missile *Final Report*
Edge, Harris L.; Sahu, Jubaraj; Heavey, Karen R.; May 1999; 37p; In English

Computational fluid dynamics calculations have been performed for a multi-body system consisting of a main missile and a number of submunitions. Numerical flow field computations have been made for various orientations and locations of submunitions using an unsteady, zonal Navier-Stokes code and the chimera composite grid discretization technique at low supersonic speeds and 0 deg angle of attack. Steady state numerical results have been obtained and compared for cases modeling six submunitions in pitch-plane symmetry and ten submunitions for which symmetry could not be exploited. Computed results show the details of the expected flow field features including the shock interactions. Computed results are compared with limited experimental data obtained for the same configuration and conditions and are generally found to be in good agreement with the data. The results help to quantify changes in the aerodynamic forces and moments, which are attributable to changes in position of the submunitions relative to one another.
DTIC
Computational Fluid Dynamics; Flow Distribution; External Store Separation; Missile Bodies; Navier-Stokes Equation

19990105690 Hawaii Univ., Dept. of Mechanical Engineering, Manoa, HI USA

Numerical Simulation of Evaporating Capillary Jets

Zeda, Jason D.; Aug. 1999; 39p; In English

Report No.(s): AD-A367314; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A detailed numerical study of evaporating capillary jets is presented. The analysis is performed through use of a Galerkin finite element method with penalty formulation for solving the equations of motion and a flux method for tracking the free surface. A parametric study is performed to analyze the temporal instability of the evaporating jet. Through varying the evaporation rate, Reynolds number, disturbance wave number, initial disturbance amplitude, and density ratio the outcomes of jet breakup are investigated. Also, pressure distribution inside the jet and multiple satellite drop formations are analyzed. Results are compared to existing analytical conclusions made from linear stability analysis. This study reveals that surface evaporation has a destabilizing effect for the low speed jets, which are considered here. That is, evaporation flux is greater at the neck than the crest, which accelerates the wave growth. Satellite drops also reduce in size as evaporation rate is increased. This reduction is seen in both the radial direction due to vapor leaving the surface and along the axis of symmetry due to decreased breakup time.
DTIC

Evaporation; Evaporation Rate; Jet Flow; Simulation

19990105708 NASA Marshall Space Flight Center, Huntsville, AL USA

Overview of Fluid Dynamics Activities at the Marshall Space Flight Center

Garcia, Roberto, NASA Marshall Space Flight Center, USA; Griffin, Lisa W., NASA Marshall Space Flight Center, USA; Wang, Ten–See, NASA Marshall Space Flight Center, USA; Sep. 13, 1999; 1p; In English; 10th; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Since its inception 40 years ago, Marshall Space Flight Center (MSFC) has had the need to maintain and advance state-of-the-art flow analysis and cold-flow testing capability to support its roles and missions. This overview discusses the recent organizational changes that have occurred at MSFC with emphasis on the resulting three groups that form the core of fluid dynamics expertise at MSFC: the Fluid Physics and Dynamics Group, the Applied Fluid Dynamics Analysis Group, and the Experimental Fluid Dynamics Group. Recently completed activities discussed include the analysis and flow testing in support of the Fastrac engine design, the X-33 vehicle design, and the X34 propulsion system design. Ongoing activities include support of the RLV vehicle design, Liquid Fly Back Booster aerodynamic configuration definition, and RLV focused technologies development. Other ongoing activities discussed are efforts sponsored by the Center Director's Discretionary Fund (CDDF) to develop an advanced incompressible flow code and to develop optimization techniques. Recently initiated programs and their anticipated required fluid dynamics support are discussed. Based on recent experiences and on the anticipated program needs, required analytical and experimental technique improvements are presented. Due to anticipated budgetary constraints, there is a strong need to leverage activities and to pursue teaming arrangements in order to advance the state-of-the-art and to adequately support concept development. Throughout this overview there is discussion of the lessons learned and of the capabilities demonstrated and established in support of the hardware development programs.
Author

Fluid Dynamics; Flow Characteristics; Management Systems; Systems Engineering; Evaluation; Engine Design

35
INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography. For aerial photography see 43 Earth Resources and Remote Sensing. For related information see also 06 Aircraft Instrumentation, and 19 Space Instrumentation.

19990100610 Los Alamos National Lab., Manuel Lujan Jr. Neutron Scattering Center, NM USA

Neutron instrument Monte Carlo library MCLIB: Recent developments

Seeger, P. A.; Daemen, L. L.; Hjelm, R. P.; Thelliez, T. G.; Dec. 31, 1998; 17p; In English; 14th; ICANS: Conference on the International Collaboration on Advanced Neutron Sources

Report No.(s): DE99-002552; LA-UR-98-3876; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A brief review is given of the developments since the ICANS-XIII meeting made in the neutron instrument design codes using the Monte Carlo library MCLIB. Much of the effort has been to assure that the library and the executing code MC(-)RUN connect efficiently with the World Wide Web application MC-WEB as part of the Los Alamos Neutron Instrument Simulation Package (NISP). Since one of the most important features of MCLIB is its open structure and capability to incorporate any possible neutron

transport or scattering algorithm, this document describes the current procedure that would be used by an outside user to add a feature to MCLIB. Details of the calling sequence of the core subroutine OPERATE are discussed, and questions of style are considered and additional guidelines given. Suggestions for standardization are solicited, as well as code for new algorithms.
NTIS
Neutron Sources; Neutron Counters

19990100661 NASA Marshall Space Flight Center, Huntsville, AL USA
Operational Methodology for the International Space Station (ISS) High Rate Communications Outage Recorder (HCOR)
Mixson, C. David, NASA Marshall Space Flight Center, USA; [2000]; 9p; In English; Space Technology and Applications International Forum, 29 Jan. 1999 - 4 Feb. 2000, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The HCOR will be used onboard the ISS to record digital data during Ku-band Loss of Signal (LOS) periods. This recorded data will be played back to the ground during Ku-band Acquisition of Signal (AOS) periods. The Data Management (DM) Team at the Payload Operations and Integration Center is the primary operator of this complex recorder. The record and playback capabilities - along with the memory management functions - are presented in this paper. To illustrate how the DM Team plans to manage the record, playback and memory management tasks of operating the HCOR, an operational scenario for a ninety-minute orbit is presented.
Author
International Space Station; Payload Integration; Spacecraft Instruments; Recording Instruments; Data Recorders

19990102039 Department of Energy, Assistant Secretary for Nuclear Energy, Washington, DC USA
Spatial resolution attainable in germanium detectors by pulse shape analysis
Blair, J.; Beckedahl, D.; Kammeraad, J.; Schmid, G.; May 01, 1998; 19p; In English; 9th; Radiation measurements and applications
Report No.(s): DE98-058639; UCRL-JC-129137; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

There are several applications for which it is desirable to calculate the locations and energies of individual gamma-ray interactions within a high purity germanium (HPGe) detector. These include gamma-ray imaging and Compton suppression. With a segmented detector this can be accomplished by analyzing the pulse shapes of the signals from the various segments. We examine the fundamental limits to the spatial resolution attainable with this approach. The primary source of error is the series noise of the field effect transistors (FETs) at the inputs of the charge amplifiers. We show how to calculate the noise spectral density at the output of the charge amplifiers due to an optimally selected FET. This calculation is based only on the detector capacitance and a noise constant for the FET technology. We show how to use this spectral density to calculate the uncertainties in parameters, such as interaction locations and energies, that are derived from pulse shape analysis using maximum likelihood estimation (MLE) applied to filtered and digitized recordings of the charge signals. Example calculations are given to illustrate our approach. Experimental results are given that demonstrate that one can construct complete systems, from detector through data analysis, that come near the theoretical limits.
NTIS
Spatial Resolution; Germanium; Detectors; Shapes

19990102911 Institute for Human Factors TNO, Soesterberg, Netherlands
Evaluation of CCD Camera Systems for the Fennek Vehicle *Final Report Evaluatie van CCD Camera's Ten Behoeve van de Fennek*
Valeton, J. M., Institute for Human Factors TNO, Netherlands; Kooi, F. L., Institute for Human Factors TNO, Netherlands; Bijl, P., Institute for Human Factors TNO, Netherlands; Aug. 25, 1999; 40p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): TNO Proj. 786.1; A98/KL/317
Report No.(s): TD-99-0335; TNO-TM-99-A057; Copyright; Avail: Issuing Activity, Hardcopy

The usefulness of a number of CCD camera systems for the German/Dutch Fennek observation pod has been explored in a field test. The observation capabilities (target detection, recognition, and identification) for stationary vehicles at a known, distant location were measured. Seven camera-display combinations have been directly compared to determine the effect of the following parameters: (1) type of camera (Fennek, RGB reference with contrast-stretching, i-Sight); (2) colour versus black-and-white; (3) field of view (2.5 deg: wide field-of-view, 0.9 deg: narrow field-of-view); and (4) display size (9 in, 14 in). The observer task in the field experiment was target identification. The experimental design was such that recognition and 'detection' performance could be obtained from the identification scores. NOTE: this 'detection' performance concerns determining whether a target is

present at a certain, known location, and is therefor different from the detection in a search task. Target search was not investigated in this study. The results indicate how the camera system presently used in the Fennek could be improved for target identification. The display size has no effect on the scores. The 'detection', recognition, and identification scores with the RGB reference camera are 10% to 15% higher, due to the 20% better resolution and the contrast-stretching. The 2.7 times stronger tele-lens (narrow field-of-view) improves the scores by 20%. Colour improves the recognition and identification of the vehicles by 7% to 10% but has no effect on detection. to summarize, of the four variables the field-of-view has the largest effect followed by resolution / stretching and colour. Though these improvements in the scores cannot directly be converted to an improvement in acquisition range, the effects should be easily noticeable. Only a relatively small effect of colour was found in this experiment because of the large distance (atmosphere effects), the limited colour discrimination capability of the human eye for small objects, and the low colour contrast of the targets (camouflage patterns). The colour contrast stretching and the high resolution of the CCD cameras apparently are not enough to compensate for these effects. It is expected however, that colour will have a much larger effect on performance for other tasks, such as visual search, and peace-keeping operations.

Author

CCD Cameras; Evaluation; Pods (External Stores); Lenses; Field Tests; Experiment Design; Color Vision

19990102915 Swedish Defence Research Establishment, Div. of Sensor Technology, Linkoeping, Sweden

Investigation of Fabry-Perot Fibre Grating Sensors *Undersoekning av Fabry-Perot Fibergitter Sensorer*

Agren, P., Swedish Defence Research Establishment, Sweden; Oct. 1998; 50p; In English; Portions of this document are not fully legible

Report No.(s): PB99-170581; FOA-R-98-00872-409-SE; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

In this work three Fabry-Perot Fibre Grating (FPFG) interferometers, fabricated at the Institute of Optical Research (IOF) in Stockholm, were tested and analyzed. Their transmission properties as a function of strain were characterized and compared to theoretical derivations based on coupled-mode theory. The measured characteristics of the FPFG-interferometer were in good agreement with the theory, although one of the interferometers gave unexpected results. A method to provide increased phase resolution using two phase shifted FPFG-interferometers was tested. In this case the optimum choice of the grating reflection and the phase shift between the interferometers were found to be 23 percent and radians, respectively. The relative phase stability for the two interfermoeters in such an arrangement is a critical parameter which was investigated. The arrangement was subjected to strain and temperature variations and it was found that the relative phase changed. Suggestions of ways to reduce this drift are given.

NTIS

Fabry-Perot Interferometers; Fiber Optics; Optical Measuring Instruments

19990102923 NASA Marshall Space Flight Center, Huntsville, AL USA

Quench Module Insert (QMI) and the Diffusion Module Insert (DMI) Furnace Development

Crouch, Myscha R., NASA Marshall Space Flight Center, USA; Carswell, William E., Alabama Univ., USA; Farmer, Jeff, NASA Marshall Space Flight Center, USA; Rose, Fred, Pace and Waite, Inc., USA; Tidwell, Paul H., II, Micro Craft, Inc., USA; [2000]; 6p; In English; Space Technology and Application International Forum (STAIF-00), 30 Jan. 2000, Albuquerque, NM, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The Quench Module Insert (QMI) and the Diffusion Module Insert (DMI) are microgravity furnaces under development at Marshall Space Flight Center. The furnaces are being developed for the first Materials Science Research Rack (MSRR-1) of the Materials Science Research Facility (MSRF), one of the first International Space Station (ISS) scientific payloads. QMI is a Bridgman furnace with quench capability for studying interface behavior during directional solidification of metallic and alloy materials. DMI will be a Bridgman-Stockbarger furnace to study diffusion processes in semiconductors. The design for each insert, both QMI and DMI, is driven by specific science, operations and safety requirements, as well as by constraints arising from resource limitations, such as volume, mass and power. Preliminary QMI analysis and testing indicates that the design meets these requirements.

Author

Bridgman Method; Directional Solidification (Crystals); Rapid Quenching (Metallurgy); Diffusion; Microgravity; Furnaces; Inserts

19990102963 NASA Glenn Research Center, Cleveland, OH USA

Instrumentation Working Group Summary

Zaller, Michelle, NASA Glenn Research Center, USA; Miake–Lye, Richard, Aerodyne Research, Inc., USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 179-186; In English; See also 19990102951; No Copy-

right; Avail: CASI; A02, Hardcopy; A03, Microfiche

The Instrumentation Working Group compiled a summary of measurement techniques applicable to gas turbine engine aerosol precursors and particulates. An assessment was made of the limits, accuracy, applicability, and technology readiness of the various techniques. Despite advances made in emissions characterization of aircraft engines, uncertainties still exist in the mechanisms by which aerosols and particulates are produced in the near-field engine exhaust. to adequately assess current understanding of the formation of sulfuric acid aerosols in the exhaust plumes of gas turbine engines, measurements are required to determine the degree and importance of sulfur oxidation in the turbine and at the engine exit. Ideally, concentrations of all sulfur species would be acquired, with emphasis on SO2 and SO3. Numerous options exist for extractive and non-extractive measurement of SO2 at the engine exit, most of which are well developed. SO2 measurements should be performed first to place an upper bound on the percentage of SO2 oxidation. If extractive and non-extractive techniques indicate that a large amount of the fuel sulfur is not detected as SO2, then efforts are needed to improve techniques for SO3 measurements. Additional work will be required to account for the fuel sulfur in the engine exhaust. Chemical Ionization Mass Spectrometry (CI-MS) measurements need to be pursued, although a careful assessment needs to be made of the sampling line impact on the extracted sample composition. Efforts should also be placed on implementing non-intrusive techniques and extending their capabilities by maximizing exhaust coverage for line-of-sight measurements, as well as development of 2-D techniques, where feasible. Recommendations were made to continue engine exit and combustor measurements of particulates. Particulate measurements should include particle size distribution, mass fraction, hydration properties, and volatile fraction. However, methods to ensure that unaltered samples are obtained need to be developed. Particulate speciation was also assigned a high priority for quantifying the fractions of carbon soot, PAH, refractory materials, metals, sulfates, and nitrates. High priority was also placed on performing a comparison of particle sizing instruments. Concern was expressed by the workshop attendees who routinely make particulate measurements about the variation in number density measured during in-flight tests by different instruments. In some cases, measurements performed by different groups of researchers during the same flight tests showed an order of magnitude variation. Second priority was assigned to measuring concentrations of odd hydrogen and oxidizing species. Since OH, HO2, H2O2, and O are extremely reactive, non-extractive measurements are recommended. A combination of absorption and fluorescence is anticipated to be effective for OH measurements in the combustor and at the engine exit. Extractive measurements of HO2 have been made in the stratosphere, where the ambient level of OH is relatively low. Use of techniques that convert HO2 to OH for combustor and engine exit measurements needs to be evaluated, since the ratio of HO2/OH may be 1% or less at both the combustor and engine exit. CI-MS might be a viable option for H2O2, subject to sampling line conversion issues. However, H2O2 is a low priority oxidizing species in the combustor and at the engine exit. Two candidates for atomic oxygen measurements are Resonance Enhanced Multi-Photon Ionization (REMPI) and Laser-Induced Fluorescence (LIF). Particulate measurement by simultaneous extractive and non-extractive techniques was given equal priority to the oxidizer measurements. Concern was expressed over the ability of typical ground test sampling lines to deliver an unaltered sample to a remotely located instrument. It was suggested that the sampling probe and line losses be checked out by attempting measurements using an optical or non-extractive technique immediately upstream of the sampling probe. This is a possible application for Laser Induced Incandescence (LII) as a check on the volume fraction of soot. Optical measurements of size distribution are not well developed for ultrafine particles less than about 20 nm in diameter, so a non-extractive technique for particulate size distribution cannot be recommended without further development. Carbon dioxide measurements need to be made to complement other extractive measurement techniques. CO2 measurements enable conversion of other species concentrations to emission indices. Carbon monoxide, which acts as a sink for oxidizing species, should be measured using non-extractive techniques. CO can be rapidly converted to CO2 in extractive probes, and a comparison between extractive and non-extractive measurements should be performed. Development of non-extractive techniques would help to assess the degree of CO conversion, and might be needed to improve the concentration measurement accuracy. Measurements of NO(x) will continue to be critical due to the role of NO and NO2 in atmospheric chemistry, and their influence on atmospheric ozone. Time-resolved measurements of temperature, velocity, and species concentrations were included on the list of desired measurement. Thermocouples are typically adequate for engine exit measurements. PIV and LDV are well established for obtaining velocity profiles. The techniques are listed in the accompanying table; are divided into extractive and non-extractive techniques. Efforts were made to include a measurement uncertainty for each technique. An assessment of the technology readiness was included.
Author

Aerosols; Exhaust Gases; Nonintrusive Measurement; Optical Measurement; Particulates; Plumes; Technology Assessment; Turbine Engines; Measuring Instruments

19990103018 NASA Marshall Space Flight Center, Huntsville, AL USA
Effective Area of the AXAF High Resolution Camera (HRC)
Patnaude, Daniel, Smithsonian Astrophysical Observatory, USA; Pease, Deron, Smithsonian Astrophysical Observatory, USA; Donnelly, Hank, Smithsonian Astrophysical Observatory, USA; Juda, Mike, Smithsonian Astrophysical Observatory, USA;

Jones, Christine, Smithsonian Astrophysical Observatory, USA; Murray, Steve, Smithsonian Astrophysical Observatory, USA; Zombeck, Martin, Smithsonian Astrophysical Observatory, USA; Kraft, Ralph, Smithsonian Astrophysical Observatory, USA; Kenter, Almus, Smithsonian Astrophysical Observatory, USA; Meehan, Gary, Smithsonian Astrophysical Observatory, USA; Meehan, Gary, Smithsonian Astrophysical Observatory, USA; Swartz, Doug, Universities Space Research Association, USA; Elsner, Ron, NASA Marshall Space Flight Center, USA; [1998]; In English, 19-25 Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The AXAF High-Resolution Camera (HRC) was calibrated at NASA MSFC's X-Ray Calibration Facility (XRCF) during 1997 March and April. We have undertaken an analysis of the HRC effective area using all data presently available from the XRCF. We discuss our spectral fitting of the beam-normalization detectors (BNDs), our method of removing higher order contamination lines present in the spectra, and corrections for beam non-uniformities. We apply a model of photon absorption depth in order to fit a smooth curve to the quantum efficiency of the detector. This is then combined with the most recent model of the AXAF High-Resolution Mirror Assembly (HRMA) to determine the ensemble effective area versus energy for the HRC. We also address future goals and concerns.
Author
Calibrating; Cameras; High Resolution; Photons; Spectral Resolution

19990103105 NASA Marshall Space Flight Center, Huntsville, AL USA
Design of a Day/Night Star Camera System
Alexander, Cheryl, NASA Marshall Space Flight Center, USA; Swift, Wesley, Alabama Univ., USA; Ghosh, Kajal, NASA Marshall Space Flight Center, USA; Ramsey, Brian, NASA Marshall Space Flight Center, USA; 1999; In English; Optical Sciences, Engineering..., 18-23 Jul. 1999, Denver, CO, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper describes the design of a camera system capable of acquiring stars during both the day and night cycles of a high altitude balloon flight (35-42 km). The camera system will be filtered to operate in the R band (590-810 nm). Simulations have been run using MODTRAN atmospheric code to determine the worse case sky brightness at 35 km. With a daytime sky brightness of 2(exp -05) W/sq cm/str/um in the R band, the sensitivity of the camera system will allow acquisition of at least 1-2 stars/sq degree at star magnitude limits of 8.25-9.00. The system will have an F2.8, 64.3 mm diameter lens and a 1340X1037 CCD array digitized to 12 bits. The CCD array is comprised of 6.8 X 6.8 micron pixels with a well depth of 45,000 electrons and a quantum efficiency of 0.525 at 700 nm. The camera's field of view will be 6.33 sq degree and provide attitude knowledge to 8 arcsec or better. A test flight of the system is scheduled for fall 1999.
Author
Design Analysis; Cameras; Field of View; Charge Coupled Devices; Attitude (Inclination); Simulation

19990103155 NASA Marshall Space Flight Center, Huntsville, AL USA
SPARCLE: Validation of Observing System Simulations (SPace Readiness Coherent Lidar Experiment)
Emmitt, G. D., NASA Marshall Space Flight Center, USA; Miller, Timothy L., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Remote Sensing, 21-25 Sep. 1998, Barcelona, Spain; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

NASA recently approved a mission to fly a Doppler Wind Lidar (DWL) on a U.S. Space Shuttle. SPARCLE, managed by Marshall Space Flight Center in Huntsville, AL, is targeted for launch in March 2001. This mission is viewed as a necessary demonstration of a solid state (2 micron) lidar using coherent detection before committing resources to a 3-5 year research or operational mission. While, to many, this shuttle mission is seen as the first step in a series leading to a fully operational wind observing system, to others, it is a chance to validate predictions of performance based upon theoretical models, analyses of airborne and ground-based data, and sophisticated observing system simulation experiments. This paper will be presented in two parts: first a brief overview of the SPARCLE mission and second, a summary of current performance predictions and key contributions from ground- based and airborne DWL research. The SPARCLE instrument is a 100 mJ, 6 Hz, diode-pumped 2-micron laser with a .25 m telescope using heterodyne mixing in a fiber and an InGaAs detector. A 25 cm silicon wedge scanner will be used in step-stare modes with dwells ranging from 60 seconds to .5 seconds. Pointing knowledge is achieved with a dedicated GPS/INS mounted close to the lidar. NASA's Hitchhiker program is providing the instrument enclosures (2 cans) and mission logistics support. An on-board data system is sized to record 150 Gbytes of raw signal from a two 400 MHZ A/D converters. On-board signal processing will be used to control the frequency of the Local Oscillator. SPARCLE is predicted to have a single shot backscatter sensitivity near 1x10(exp -6) m-1 sr-1, to achieve higher sensitivity, shot accumulation will be employed. Ground-based, 2 micron DWLs have been used to assess the benefits of shot accumulation (approximately SQRT for SNR). Airborne programs like MACAWS have provided good datasets for evaluating various sampling strategies and signal processing algorithms. Using these

real data to calibrate our simulation models, we can describe when and how well SPARCLE is expected to preform. Outputs from these performance models will be presented.

Author

Lasers; Optical Radar; Performance Prediction; Space Missions; Spaceborne Experiments

19990103156 NASA Marshall Space Flight Center, Huntsville, AL USA

Photodeposition Technique for Storing Holographic Images on Thin Films of Polydiacetylene

Abdeldayem, Hossin, NASA Marshall Space Flight Center, USA; Paley, Mark S., NASA Marshall Space Flight Center, USA; Witherow, William, NASA Marshall Space Flight Center, USA; Frazier, Donald O., NASA Marshall Space Flight Center, USA; 1998; 4p; In English, 8-12 Jun. 1998, Kailua-Kona, HI, USA

Contract(s)/Grant(s): NAS8-66; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We present a novel photodeposition technique for depositing a permanent storing holographic grating , made of a thin film of a polydiacetylene derivative.

Author

Deposition; Holography; Thin Films; Photopolymers; Polymer Blends

19990103924 Los Alamos National Lab., NM USA

Recursive estimation for the tracking of radioactive sources

Howse, J. W.; Ticknor, L. O.; Muske, K. R.; Dec. 31, 1998; 6p; In English; 1999 American control conference

Report No.(s): DE99-002751; LA-UR-98-4026; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

This paper describes a recursive estimation algorithm used for tracking the physical location of radioactive sources in real-time as they are moved around in a facility. The algorithm is related to a nonlinear least squares estimation that minimizes the change in the source location and the deviation between measurements and model predictions simultaneously. The measurements used to estimate position consist of four count rates reported by four different gamma ray detectors. There is an uncertainty in the source location due to the large variance of the detected count rate. This work represents part of a suite of tools which will partially automate security and safety assessments, allow some assessments to be done remotely, and provide additional sensor modalities with which to make assessments.

NTIS

Algorithms; Radiation Detectors; Radioactive Materials; Radioactivity; Real Time Operation

19990103947 NASA Marshall Space Flight Center, Huntsville, AL USA

Shuttle and Transfer Orbit Thermal Analysis and Testing of the Chandra X-Ray Observatory Charge-Couple Device Imaging Spectrometer Radiator Shades

Sharp, John R., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Thermal analyses of the Shuttle and Transfer Orbit of the Advanced X-Ray Astrophysics Facility Charge-Coupled Device (CCD) Imaging Spectrometer (ACIS), one of two science instruments on the Chandra X-Ray Observatory, revealed a low-earth orbit (LEO) overheating problem on the goldized Kapton faces of two radiator shades. The shades were coated with the goldized Kapton to provide a low hemispherical emittance to minimize direct and backloaded heating from the sun and the observatory and high specularity to optimize the coupling to space on two passive radiators which cool the focal plane to -120 C +/- 1 C during on-orbit operations. Since the observatory has a highly elliptical final orbit of 10,000 kilometers by 140,000 kilometers and the ACIS radiators and shades are oriented anti-sun, the high solar absorptance to emittance ratio of the goldized Kapton was not an issue. However, during Shuttle bay-to-earth operations, the short duration solar heating occurring near the eclipse entry and exit resulted in shade temperatures in excess of the cure temperature of the adhesive used to bond the goldized Kapton and honeycomb face-sheets. The detailed thermal analysis demonstrating the LEO overheating as well as the redesign options and thermal testing of a redesigned development unit shade are presented.

Author

Thermal Analysis; Performance Tests; Coatings; Evaluation; Kapton (Trademark); X Ray Imagery

19990103970 NASA Marshall Space Flight Center, Huntsville, AL USA

Mir Glovebox Facility

Kroes, Roger L., NASA Marshall Space Flight Center, USA; Reiss, Donald A., NASA Marshall Space Flight Center, USA; 1998; 1p; In English, 1 Apr. 1998, San Jose, CA, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Glovebox Facility on Mir was developed by the Marshall Space Flight Center for use on the space shuttle middeck and modified slightly for use on the Mir Space Station. Its design is based on a similar facility provided by the European Space Agency for use on Spacelab and flown on the USML-I and 2 missions. Its purpose is to provide a work space for experiments which is isolated from the manned environment while allowing a high degree of access to the experiment apparatus. It also provides experiment power, lighting, and data acquisition. This facility has successfully supported 7 experiments representing the fluid physics and combustion disciplines during NASA increments 2 - 5. During over 400 hours of operation, only 3 minor facility anomalies were encountered, none of which prevented science operations or resulted in hazardous conditions. No in-flight maintenance has been required through increment 5. Crew comments have been generally favorable, stressing the usefulness, reliability and ease of use of the facility. The success of the glovebox to date demonstrates the value of this type of multi-use facility in a space station environment.

Author

Mir Space Station; Spaceborne Experiments; Space Processing; Space Laboratories; Research Facilities

19990105713 NASA Langley Research Center, Hampton, VA USA

Uncertainty Analysis of Instrument Calibration and Application

Tripp, John S., NASA Langley Research Center, USA; Tcheng, Ping, NASA Langley Research Center, USA; October 1999; 78p; In English

Contract(s)/Grant(s): RTOP 519-20-21-01

Report No.(s): NASA/TP-1999-209545; NAS 1.60:209545; L-17652; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Experimental aerodynamic researchers require estimated precision and bias uncertainties of measured physical quantities, typically at 95 percent confidence levels. Uncertainties of final computed aerodynamic parameters are obtained by propagation of individual measurement uncertainties through the defining functional expressions. In this paper, rigorous mathematical techniques are extended to determine precision and bias uncertainties of any instrument-sensor system. Through this analysis, instrument uncertainties determined through calibration are now expressed as functions of the corresponding measurement for linear and nonlinear univariate and multivariate processes. Treatment of correlated measurement precision error is developed. During laboratory calibration, calibration standard uncertainties are assumed to be an order of magnitude less than those of the instrument being calibrated. Often calibration standards do not satisfy this assumption. This paper applies rigorous statistical methods for inclusion of calibration standard uncertainty and covariance due to the order of their application. The effects of mathematical modeling error on calibration bias uncertainty are quantified. The effects of experimental design on uncertainty are analyzed. The importance of replication is emphasized, techniques for estimation of both bias and precision uncertainties using replication are developed. Statistical tests for stationarity of calibration parameters over time are obtained.

Author

Bias; Precision; Errors; Calibrating

19990105716 Northwestern Univ., Dept. of Physics and Astronomy, Evanston, IL USA

Journal of Magnetism and Magnetic Materials

Freeman, A. J.; Jun. 01, 1999; Volume 198-199; 795p; In English

Report No.(s): AD-A367368; No Copyright; Avail: CASI; A10, Microfiche; A99, Hardcopy

The Journal of Magnetism and Magnetic Materials provides an important forum for the disclosure and discussion of original contributions covering the whole spectrum of topics, from basic magnetism to the technology and applications of magnetic materials and magnetic recording. The journal encourages greater interaction between the basic and applied subdisciplines of magnetism, with short but comprehensive review articles, a rapid publication channel with Letters to the Editors, and a section Information Storage: Basic and Applied on all topics in magnetic and magneto-optic recording media and processes in addition to full-length contributions.

DTIC

Magnetic Materials; Magnetic Properties

36
LASERS AND MASERS

Includes parametric amplifiers. For related information see also 76 Solid-State Physics.

19990100597 Department of Energy, Office of Energy Research, Washington, DC USA
Observation of stimulated raman scattering in an optical fiber at the Fermilab A0 photo injector
Fry, A. R.; Taylor, B.; Fitch, M. J.; Melissinos, N. C.; Sep. 30, 1998; 11p; In English
Report No.(s): DE98-059564; FNAL-TM-2054; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
    We have observed stimulated Raman scattering in a 2 km long optical fiber injected with an 81 MHz train of approximately 80 ps pulses from a modelocked Nd:YLF oscillator operating at lambda = 1054 nm.
NTIS
Injectors; Raman Spectra; Optical Fibers

19990102041 Department of Energy, Washington, DC USA
Prospects for fluorescence based imaging/visualization of hydrodynamic systems on the National Ignition Facility
Suter, L.; Jun. 04, 1998; 14p; In English; 12th; Topical conference on high-temperature plasma diagnostics
Report No.(s): DE98-058628; UCRL-JC-130980; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
    The next generation of large, high power lasers, such as the National Ignition Facility (NIF) (1) in the USA, Laser Mega Joule (2) in France or Helen Successor (3) in the UK offer the prospect of x-ray fluorescence based diagnosis of hydrodynamic experiments. The x-ray fluorescence could be pumped by at least two techniques. One technique is to use a sizable fraction of these facilities' high power to efficiently make multi-kilovolt x-rays which, in turn, causes dopants placed in experimental packages to fluoresce. We call this 'externally pumped x-ray fluorescence'. The second technique is to use the sizable multi-kilovolt photon background that we expect to be present in many hohlraum based experiments, while the driving laser is on, to pump x-ray fluorescence. The fluorescing medium could be a dopant in an experimental package or, possibly, a relatively thick slab of material in the hohlraum wall which could serve as a backlighte. We call this 'hohlraum hot-corona pumped fluorescence.'
NTIS
Imaging Techniques; X Ray Fluorescence; Hydrodynamics

19990105722 Academy of Sciences (USSR), General Physics Inst., Moscow, USSR
Powerful Optical Parametric Oscillator (OPO) on GaSe Crystal Pumped by an 3-Micron Laser *Final Report*
Kulevsky, Lev A.; Jul. 30, 1999; 23p; In English
Contract(s)/Grant(s): F61775-98-W-E052
Report No.(s): AD-A367437; EOARD-SPC-98-4045; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    The proposed research should demonstrate an extension our project on resonator optical parametric oscillation (OPO) in a GaSe crystal pumped by an switched three micron laser. Our previous work demonstrated feasibility of obtaining of resonator-type OPO on GaSe. At this phase we were concentrating on obtaining powerful tuneable IR radiation. The work should consist of improving of pump laser system and architecture of GaSe OPO in order to have 10 mJ tuneable IR near 6 micron with 20% conversion efficiency.
DTIC
Research; Infrared Lasers; Crystals; Infrared Radiation; Lasers; Parametric Amplifiers

37
MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

19990100618 Harvard Univ., Div. of Engineering and Applied Sciences, Cambridge, MA USA
Clouds and Water Vapor in the Climate System: Remotely Piloted Aircraft and Satellites*, 1 Jul. 1996 - 28 Feb. 1999*
Anderson, James G., Harvard Univ., USA; Oct. 01, 1999; 25p; In English
Contract(s)/Grant(s): NAG1-1849; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    The objective of this work was to attack unanswered questions that lie at the intersection of radiation, dynamics, chemistry and climate. Considerable emphasis was placed on scientific collaboration and the innovative development of instruments required to address these scientific issues. The specific questions addressed include: Water vapor distribution in the Tropical Tro-

posphere: An understanding of the mechanisms that dictate the distribution of water vapor in the middle-upper troposphere; Atmospheric Radiation: In the spectral region between 200 and 600/cm that encompasses the water vapor rotational and continuum structure, where most of the radiative cooling of the upper troposphere occurs, there is a critical need to test radiative transfer calculations using accurate, spectrally resolved radiance observations of the cold atmosphere obtained simultaneously with in situ species concentrations; Thin Cirrus: Cirrus clouds play a central role in the energy and water budgets of the tropical tropopause region; Stratosphere-Troposphere Exchange: Assessment of our ability to predict the behavior of the atmosphere to changes in the boundary conditions defined by thermal, chemical or biological variables; Correlative Science with Satellite Observations: Linking this research to the developing series of EOS observations is critical for scientific progress.
Derived from text
Water Vapor; Climate; Cirrus Clouds; Atmospheric Temperature; Boundary Conditions; Radiation Chemistry; Dynamic Characteristics

19990100884 NASA Marshall Space Flight Center, Huntsville, AL USA
Nondestructive Evaluation of the Friction Weld Process on 2195/2219 Grade Aluminum
Suits, Michael W., NASA Marshall Space Flight Center, USA; Clark, Linda S., NASA Marshall Space Flight Center, USA; Cox, Dwight E., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English, 23-25 Mar. 1999, Orlando, FL, USA; Sponsored by American Society of Nondestructive Testing, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

   In 1996, NASA's Marshall Space Flight Center began an ambitious program designed to find alternative methods of repairing conventional TIG (Tungsten Inert Gas) welds and VPPA (Variable Polarity Plasma Arc) welds on the Space Shuttle External Tank without producing additional heat-related anomalies or conditions. Therefore, a relatively new method, invented by The Welding Institute (TWI) in Cambridge, England, called Friction Stir Welding (FSW), was investigated for use in this application, as well as being used potentially as an initial weld process. As with the conventional repair welding processes, nondestructive evaluation (NDE) plays a crucial role in the verification of these repairs. Since it was feared that conventional NDE might have trouble with this type of weld structure (due to shape of nugget, grain structure, etc.) it was imperative that a complete study be performed to address the adequacy of the NDE process. This paper summarizes that process.
Author
Nondestructive Tests; Friction Welding; Aluminum; Plasmas (Physics)

19990102902 NASA Marshall Space Flight Center, Huntsville, AL USA
SSME HPFTP/AT Turbine Blade Platform Featherseal Damper Design
Montgomery, S. K., NASA Marshall Space Flight Center, USA; 1999; In English; 35th; Joint Propulsion, 20-24 Jun. 1999, Los Angeles, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics
Contract(s)/Grant(s): NAS8-36801; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

   During the Space Shuttle Main Engines (SSM) HPFtP/AT development program, engine hot fire testing resulted in turbine blade fatigue cracks. The cracks were noted after only a few tests and a several hundred seconds versus the design goal of 60 tests and is greater than 30,000 seconds. Subsequent investigation attributed the distress to excessive steady and dynamic loads. to address these excessive turbine blade loads, Pratt & Whitney Liquid Space Propulsion engineers designed and developed retrofitable turbine blade to blade platform featherseal dampers. Since incorporation of these dampers, along with other turbine blade system improvements, there has been no observed SSME HPFTP/AT turbine blade fatigue cracking. The high time HPFTP/AT blade now has accumulated 32 starts and 19,200 seconds hot fire test time. Figure #1 illustrates the HPFTP/AT turbine blade platform featherseal dampers. The approached selected was to improve the turbine blade structural capability while simultaneously reducing loads. to achieve this goal, the featherseal dampers were designed to seal the blade to blade platform gap and damp the dynamic motions. Sealing improves the steady stress margins by increasing turbine efficiency and improving turbine blade attachment thermal conditioning. Load reduction was achieved through damping. Thin Haynes 188 sheet metal was selected based on its material properties (hydrogen resistance, elongation, tensile strengths, etc.). The 36,000 rpm wheel speed of the rotor result in a normal load of 120#/blade. The featherseals then act as micro-slip dampers during actual SSME operation. After initial design and analysis (prior to full engine testing), the featherseal dampers were tested in P&W's spin rig facility in West Palm Beach, Florida. Both dynamic strain gages and turbine blade tip displacement measurements were utilized to quantify the featherseal damper effectiveness. Full speed (36,000 rpm), room temperature rig testing verified the elimination of fundamental mode (i.e, modes 1 & 2) resonant response. The reduction in turbine blade dynamic response is shown for a typical turbine blade. This paper discusses the design and verification of these dampers. The numerous benefits associated with this design concept warrants consideration in existing and future turbomachinery applications.
Author
Damping; Engine Tests; Sealing; Space Shuttle Main Engine; Turbine Blades; Turbomachinery

19990103594 NASA Goddard Space Flight Center, Greenbelt, MD USA

Flight Performance of the Balloon Gondola Solar Pointing System

Simpson, Joel, NASA Goddard Space Flight Center, USA; Hall, Kenneth, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 13th; International Balloon Technology, 28 Jun. - 1 Ju. 1999, Norfolk, VA, USA; Sponsored by American Inst. of Aeronautics and Astronautics; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The NASA Solar Pointing System (SPS) has made two operational flights since its test flight in April of 1997. This pointing device was conceived and designed to provide ultra-low power gondola pointing primarily for directing gondola-fixed solar panels toward the sun. While typically consuming less than 5 watts, the system is capable of suspending and pointing up to 3400 kg, The SPS has logged over 25 days of mostly continuous operation. The performance data, including power consumption and pointing accuracy for these two successful flights is presented and analyzed. The data is compared to predictions and test flight data Suggestions for further developments and applications including Ultra-Long Duration Balloon (ULDB) are discussed.
Author

Balloon-Borne Instruments; Gondolas; Pointing Control Systems; Flight Control

19990104278 NASA Johnson Space Center, Houston, TX USA

Torque-Limiting Manipulation Device

Moetteli, John B., Inventor, NASA Johnson Space Center, USA; Jul. 20, 1999; In English
Patent Info.: Filed 28 Jan. 1997; NASA-Case-MSC-22595-1; US-Patent-5,924,329; US-Patent-Appl-SN-789259; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A device for manipulating a workpiece in space includes a fixture, a stanchion assembly, a manipulation mechanism, an actuation mechanism, and a reaction mechanism. The fixture has an end onto which the workpiece affixes. The stanchion assembly has an upper and a lower end. The manipulation mechanism connects the fixture and the upper end of the stanchion assembly. The lower end of the stanchion assembly mounts, via probe and a socket, to a structure. The actuation mechanism operably connects to the manipulation mechanism, and moves the fixture in space. The reaction mechanism provides a point through which force inputs into the actuation mechanism may react.
Author

Torque; Torque Sensors (Robotics); Manipulators; Control Equipment; End Effectors; Actuators

19990104285 NASA Langley Research Center, Hampton, VA USA

Carbon Fiber Reinforced Carbon Composite Valve for an Internal Combustion Engine

Rivers, H. Kevin, Inventor, NASA Langley Research Center, USA; Ransone, Philip O., Inventor, NASA Langley Research Center, USA; Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Aug. 10, 1999; In English
Patent Info.: Filed 12 Mar. 1997; NASA-Case-LAR-15274-1; US-Patent-5,934,648; US-Patent-Appl-SN-828818; US-Patent-Appl-SN-014188; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A carbon fiber reinforced carbon composite valve for internal combustion engines and the like formed of continuous carbon fibers throughout the valve's stem and head is disclosed. The valve includes braided carbon fiber material over axially aligned unidirectional carbon fibers forming a valve stem; the braided and unidirectional carbon fibers being broomed out at one end of the valve stem forming the shape of the valve head; the valve-shaped structure being densified and rigidized with a matrix of carbon containing discontinuous carbon fibers: and the finished valve being treated to resist oxidation. Also disclosed is a carbon matrix plug containing continuous and discontinuous carbon fibers and forming a net-shape valve head acting as a mandrel over which the unidirectional and braided carbon fibers are formed according to textile processes. Also disclosed are various preform valves and processes for making finished and preform carbon fiber reinforced carbon composite valves.
Official Gazette of the U.S. Patent and Trademark Office

Carbon-Carbon Composites; Reinforcing Fibers; Valves; Plugs

19990105700 Boeing Co., Rocketdyne Div., Canoga Park, CA USA

Unshrouded Centrifugal Turbopump Impeller

Prueger, George, Boeing Co., USA; Williams, Morgan, Boeing Co., USA; Chen, Wei, Boeing Co., USA; Paris, John, Boeing Co., USA; Stewart, Eric, Boeing Co., USA; Williams, Robert, Boeing Co., USA; Sep. 13, 1999; 1p; In English; 10th; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA
Contract(s)/Grant(s): NAS8-98259; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The ratio of rocket engine thrust to weight is a limiting constraint in placing more payload into orbit at a low cost. A key component of an engine's overall weight is the turbopump weight, Reducing the turbopump weight can result in significant engine weight reduction and hence, increased delivered payload. There are two main types of pumps: centrifugal and axial pumps. These

types of pumps can be further sub-divided into those with shrouds and those without shrouds (unshrouded pumps). Centrifugal pumps can achieve the same pump discharge pressure as an axial pump and it requires fewer pump stages and lower pump weight than an axial pump. Also, with unshrouded centrifugal pumps (impeller), the number of stages and weight can be further reduced. However. there are several issues with regard to using an unshrouded impeller: 1) there is a pump performance penalty due to the front open face recirculation flow; 2) there is a potential pump axial thrust problem from the unbalanced front open face and the back shroud face; and, 3) since test data is very linu'ted for this configuration, there is uncertainty in the magnitude and phase of the rotordynamics forces due to the front impeller passage. The purpose of the paper is to discuss the design of an unshrouded impeller and to examine the design's hydrodynamic performance, axial thrust, and rotordynamics performance. The design methodology will also be discussed. This work will help provide some guidelines for unshrouded impeller design. In particular, the paper will discuss the design of three unshrouded impellers - one with 5 full and 5 partial blades (5+5). one with 6+6 blades and one with 8+8 blades. One of these designs will be selected for actual fabrication and flow test. Computational fluid dynamics (CFD) is used to help design and optimize the unshrouded impeller. The relative pump performance penalty is assessed by comparing the CFD results of the unshrouded impeller with the equivalent shrouded impeller for a particular design. Limited unshrouded - versus - shrouded impeller data from the J-2 pump is used to anchor the CFD. Since no detailed impeller blade force data is available, axial thrust and rotordynamic force predictions are based on the CFD model. For the axial thrust, the impeller front flow passage axial force is integrated from the CFD results and compared to the equivalent shrouded impeller axial force. For the rotordynamics forces, the fluid reaction forces are computed from unsteady flow CFD results using a moving boundary method; the rotor- shaft is moved at several whirl-to-speed frequency ratios to extract the rotordynamics coefficients.
Author
Shrouds; Centrifugal Force; Impellers; Design Analysis; Rotor Blades (Turbomachinery); Rotor Dynamics; Turbine Pumps; Fabrication

19990105707 NASA Langley Research Center, Hampton, VA USA
Lightweight Exhaust Manifold and Exhaust Pipe Ducting for Internal Combustion Engines
Northam, G. Burton, Inventor, NASA Langley Research Center, USA; Ransone, Philip O., Inventor, NASA Langley Research Center, USA; Rivers, H. Kevin, Inventor, NASA Langley Research Center, USA; Jul. 27, 1999; In English; Provisional US-Patent-Appl-SN-012939, filed 6 Mar. 1996
Patent Info.: Filed 5 Mar. 1997; NASA-Case-LAR-15497-1; US-Patent-5,927,070; US-Patent-Appl-SN-816404; US-Patent-Appl-SN-012939; No Copyright; Avail: US Patent and Trademark Office, Hardcopy
    An improved exhaust system for an internal combustion gasoline-and/or diesel-fueled engine includes an engine exhaust manifold which has been fabricated from carbon- carbon composite materials in operative association with an exhaust pipe ducting which has been fabricated from carbon-carbon composite materials. When compared to conventional steel. cast iron. or ceramic-lined iron paris. the use of carbon-carbon composite exhaust-gas manifolds and exhaust pipe ducting reduces the overall weight of the engine. which allows for improved acceleration and fuel efficiency: permits operation at higher temperatures without a loss of strength: reduces the "through-the wall" heat loss, which increases engine cycle and turbocharger efficiency and ensures faster "light-off" of catalytic converters: and, with an optional thermal reactor, reduces emission of major pollutants, i.e. hydrocarbons and carbon monoxide.
Official Gazette of the U.S. Patent and Trademark Office
Exhaust Systems; Diesel Engines; Internal Combustion Engines; Exhaust Gases; Contaminants; Carbon-Carbon Composites

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QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

19990100630 Amarillo National Resource Center for Plutonium, Amarillo, TX USA
Time series modeling of system self-assessment of survival
Lu, H.; Kolarik, W. J.; Dec. 31, 1999; 6p; In English
Report No.(s): DE99-002709; ANRCP-99002709; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
    Self-assessment of survival for a system, subsystem or component is implemented by assessing conditional performance reliability in real-time, which includes modeling and analysis of physical performance data. This paper proposes a time series analysis approach to system self-assessment (prediction) of survival. In the approach, physical performance data are modeled in a time series. The performance forecast is based on the model developed and is converted to the reliability of system survival. In contrast to a standard regression model, a time series model, using on-line data, is suitable for the real-time performance prediction. This

paper illustrates an example of time series modeling and survival assessment, regarding an excessive tool edge wear failure mode for a twist drill operation.

NTIS

Time Series Analysis; Survival; Systems Analysis

19990104280 NASA Langley Research Center, Hampton, VA USA

Radially Focused Eddy Current Sensor for Detection of Longitudinal Flaws in Metallic Tubes

Wincheski, Russell A., Inventor, NASA Langley Research Center, USA; Simpson, John W., Inventor, NASA Langley Research Center, USA; Fulton, James P., Inventor, NASA Langley Research Center, USA; Nath, Shridhar C., Inventor, NASA Langley Research Center, USA; Todhunter, Ronald G., Inventor, NASA Langley Research Center, USA; Namkung, Min, Inventor, NASA Langley Research Center, USA; Aug. 24, 1999; In English

Patent Info.: Filed 13 Sep. 1995; NASA-Case-LAR-15330-1; US-Patent-5,942,894; US-Patent-Appl-SN-527741; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A radially focused eddy current sensor detects longitudinal flaws in a metal tube. A drive coil induces eddy currents within the wall of the metal tube. A pick-up cod is spaced apart from the drive coil along the length of the metal tube. The pick@up coil is positioned with one end thereof lying adjacent the wall of the metal tube such that the pick-up coil's longitudinal axis is perpendicular to the wall of the metal tube. to isolate the pick-up coil from the magnetic flux of the drive coil and the flux from the induced eddy currents. except the eddy currents diverted by a longitudinal flaw. an electrically conducting material high in magnetic permeability surrounds all of the pick-up coil except its one end that is adjacent the walls of the metal tube. The electrically conducting material can extend into and through the drive coil in a coaxial relationship therewith.

Official Gazette of the U.S. Patent and Trademark Office

Eddy Currents; Magnetic Flux; Focusing; Charge Flow Devices

19990104331 Tokyo Univ., Faculty of Engineering, Japan

Mechanical Characterization of PVD/CVD TiN Coated WC/Co by Acoustic Spectro-Microscopy

Aizawa, Tatsuhiko, Tokyo Univ., Japan; Kihara, Junji, Tokyo Univ., Japan; Journal of the Faculty of Engineering the University of Tokyo. Series B; Sep. 1993; ISSN 0563-7937; Volume 62, No. 2, pp. 155-168; In English

Contract(s)/Grant(s): MOESC-03505003; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

A new quantitative nondestructive evaluation method was proposed and developed by the physical vapor deposition (PVD) and chemical vapor deposition (CVD) for ceramic coated tool materials in the technology of plasticity. With use of our developed acoustic spectro microscopy, microstructural dependency of elastic properties was investigated for WC/Co superhard materials to describe both WC grain growth and agglomeration of free Co-phase from metallurgy-micromechanical point of view. The Young's moduli of PVD/CVD TiN coatings were estimated by the dispersion analysis of (coating) + (substrate) system of materials together with evaluation of the residual stress induced inside the coatings. The stress relief was also quantitatively evaluated for heat treatment design of TiN-Ti(CN) coatings.

Author

Vapor Deposition; Ceramic Coatings; Nondestructive Tests; Elastic Properties; Residual Stress; Titanium Nitrides; Tungsten Carbides; Microstructure

39
STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress. For applications see 05 Aircraft Design, Testing and Performance and 18 Spacecraft Design, Testing and Performance.

19990102054 Department of Energy, Washington, DC USA

Curvature of a cantilever beam subjected to an equi-biaxial bending moment

Krulevitch, P.; Johnson, G. C.; Apr. 28, 1998; 10p; In English; Spring meeting of the Materials Research Society

Report No.(s): DE98-054788; UCRL-JC-130440; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Results from a finite element analysis of a cantilever beam subjected to an equi-biaxial bending moment demonstrate that the biaxial modulus E/(I-v) must be used even for narrow beams.

NTIS

Curvature; Cantilever Beams; Bending Moments

19990102918 General Electric Co., Schenectady, NY USA
Materials property testing using a stress-strain microprobe
Panayotou, N. F.; Baldrey, D. G.; Haggag, F. M.; Sep. 30, 1998; 14p; In English
Report No.(s): DE99-001978; KAPL-P-000189; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The Stress-Strain Microprobe (SSM) uses an automated ball indentation technique to obtain flow data from a localized region of a test specimen or component. This technique is used to rapidly determine the yield strength and microstructural condition of a variety of materials including pressure vessel steels, stainless steels, and nickel-base alloys. The SSM provides an essentially non-destructive technique for the measurement of yield strength data. This technique is especially suitable for the study of complex or highly variable microstructures such as weldments and weld heat affected zones. In this study 119 distinct SSM determinations of the yield strength of eight engineering alloys are discussed and compared to data obtained by conventional tensile tests. The sensitivity of the SSM to the presence of residual stresses is also discussed.
NTIS
Microanalysis; Stress-Strain Relationships

19990103009 NASA Marshall Space Flight Center, Huntsville, AL USA
Probabilistic Structural Analysis of the SRB Aft Skirt External Fitting Modification
Townsend, John S., NASA Marshall Space Flight Center, USA; Peck, J., NASA Marshall Space Flight Center, USA; Ayala, S., NASA Marshall Space Flight Center, USA; 1999; In English; 40th; Structures, Structural Dynamics and Materials, 12-15 Apr. 1999, Saint Jouis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

NASA has funded several major programs (the PSAM Project is an example) to develop Probabilistic Structural Analysis Methods and tools for engineers to apply in the design and assessment of aerospace hardware. A probabilistic finite element design tool, known as NESSUS, is used to determine the reliability of the Space Shuttle Solid Rocket Booster (SRB) aft skirt critical weld. An external bracket modification to the aft skirt provides a comparison basis for examining the details of the probabilistic analysis and its contributions to the design process.
Author
Finite Element Method; Reliability; Structural Analysis; Weld Tests; Probability Theory

19990103043 Los Alamos National Lab., NM USA
Detection of damage in axial (membrane) systems
Duffey, T. A.; Baker, W. E.; Farrar, C. R.; Rhee, W. H.; Dec. 31, 1998; 7p; In English; 17th; International model analysis conference
Report No.(s): DE99-002601; LA-UR-98-3822; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

In a recent paper, two methods of damage identification (Modified Damage Index and Change-in-Flexibility) were applied to detection of damage in an 8-DOF vibrating system. The goal of the work was to detect damage (reduction in stiffness of one or more of the elements) as well as to locate the particular damaged elements (S). However, the investigation was limited to numerical simulations only. In this paper, a physical, spring-mass model of a similar, degenerate 8-DOF system (7 normal modes plus a rigid-body mode) was constructed. Experiments were then performed and the modal properties of the system were determined in undamaged and damaged states. Excitation was provided either by an impact hammer or by an electromechanical shaker. Damage was induced by replacing one of the springs with a spring of lower stiffness. The Modified Damage Index method clearly isolated the location of damage for a variety of damage locations and levels of damage. The Change-in-Flexibility method, however, was found to be less reliable. The ability of the method to locate damage depended strongly on location and the level of damage as well as the number of modes included.
NTIS
Damage; Membranes; System Failures

19990103083 Technische Univ., Faculty of Aerospace Engineering, Delft, Netherlands
On the Buckling of Imperfect Anisotropic Shells with Elastic Edge Supports Under Combined Loading Part I:, Pt. 1, Theory and Numerical Analysis *Final Report, 8 Apr. 1996 - 30 Nov. 1998*
Arbocz, Johann, Technische Univ., Netherlands; deVries, J., Technische Univ., Netherlands; Hol, J. M. A. M., Technische Univ., Netherlands; September 1998; 158p; In English
Contract(s)/Grant(s): NAG1-1826
Report No.(s): M-849-Pt-1; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

A rigorous solution is presented for the case of stiffened anisotropic cylindrical shells with general imperfections under combined loading, where the edge supports are provided by symmetrical or unsymmetrical elastic rings. The circumferential depen-

dence is eliminated by a truncated Fourier series. The resulting nonlinear 2-point boundary value problem is solved numerically via the "Parallel Shooting Method". The changing deformation patterns resulting from the different degrees of interaction between the given initial imperfections and the specified end rings are displayed. Recommendations are made as to the minimum ring stiffnesses required for optimal load carrying configurations.
Author
Anisotropic Shells; Cylindrical Bodies; Boundary Value Problems; Fourier Series; Deformation

19990104347 Building and Construction Research TNO, Centre for Mechanical Engineering, Delft, Netherlands
Fatigue Behaviour of Two Wire Rope Mounts, Type Z20313-08
vanBragt, F. J., Building and Construction Research TNO, Netherlands; Apr. 10, 1999; 18p; In English; Original contains color illustrations
Contract(s)/Grant(s): A96/KM/134; TNO Proj. 006.93225.01.01
Report No.(s): TD99-0078; TNO-99-CMC-R004; Copyright; Avail: Issuing Activity (TNO Building and Construction Research, Centre for Mechanical Engineering, Schoemakerstraat 97, P.O. Box 49, 2600 AA Delft, The Neth, Hardcopy
     The fatigue behaviour of two wire rope mounts, type Z203013-08, mounted together at an angle of 45 degrees with the horizontal base, is determined. The wire rope mounts will support the propulsion raft on the Troika drone. No serious problems have been ascertained during the endurance test.
Author
Wire; Cables (Ropes); Fatigue (Materials)

19990104606 Materials Research Society, Warrendale, PA USA
Fracture and Ductile vs. Brittle Behavior - Theory, Modelling and Experiment. Symposium Held November 30-December 3, 1998, Boston, Massachusetts. Volume 539
Beltz, Glenn E.; Selinger, Robin L.; Kim, Kyung–Suk; Marder, Michael P.; Jan. 1999; 328p; In English
Contract(s)/Grant(s): N00014-99-1-0243
Report No.(s): AD-A367261; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche
     This volume contains papers presented at the 1998 MRS Fall Meeting in Boston, Massachusetts, in Symposium M, entitled "Fracture and Ductile vs. Brittle Behavior-Theory, Modelling and Experiment." The symposium brought together the many communities that investigate the fundamentals of fracture, with special emphasis on the ductile/brittle transition across a broad spectrum of material classes, fracture at interfaces, and modelling fracture over various length scales. Theoretical techniques discussed ranged from first-principles electronic structure theory to atomistic simulation to mesoscale and continuum theories, along with studies of fractals and scaling in fracture. Experimental and theoretical talks were interspersed throughout all sessions, rather than being segregated. The contributions to this volume generally follow the topical outline upon which the symposium was organized. The first part, dealing with ductile vs. brittle behavior in metals, concerns itself with investigations of high-strength steel, magnesium alloys, ordered intermetallics, and Fe-Cr-Al alloys. The development of analytical methods based on micromechanical models, such as dislocation mechanics and cohesive/contact zone models, are covered in a follow-up section. Nonmetals, including silicon, are considered in Parts III and IV. Fractals, chaos, and scaling theories are taken up in Part V, with a special emphasis on fracture in heterogeneous solids. Modelling based on large populations of dislocations has substantially progressed during the past three years, hence, a section devoted to crystal plasticity and mesoscale dislocation modelling appears next. Finally, the technologically significant area of interfacial fracture, with applications to composites and intergranular fracture, is taken up in Part VII.
DTIC
Conferences; Fracturing; Fracture Mechanics; Crack Propagation; Brittleness; Ductile-Brittle Transition; Ductility; Plastic Deformation

19990105720 Purdue Univ., School of Aeronautics and Astronautics, West Lafayette, IN USA
Instrumentation for Full Field Deformation Measurement with Nano-Second Resolution *Final Report, 1 Apr. 1997 - 31 Dec. 1998*
Espinosa, Horacio D.; Nov. 01, 1998; 15p; In English
Contract(s)/Grant(s): F49620-97-1-0280
Report No.(s): AD-A367428; AFRL-SR-BL-TR-99-0208; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy
     The accurate evaluation of the dynamic fracture toughness of advanced materials is becoming increasingly important. Under dynamic fracture, material at the crack tip is strained suddenly, and if is rate sensitive, may offer more resistance to fracture than at quasi-static strain rates. High stain rate fracture testing is of interest because many structural components are subject to high loading rates in service or must survive high loading rates during accident conditions. Thus, these components must be designed

against crack initiation under high loading rates or to arrest a rapidly propagating crack. The fracture toughness of a material loaded suddenly is generally higher than when the load is applied quasi-statically; therefore, dynamic toughness is an effective design parameters. While there exists standardized method for determining the fracture toughness parameters K(IC) and J(IC) under quasi-static loading, to date, a unified view on the best measurement procedure to determine the dynamic fracture toughness of advanced materials has not been achieved. Hence, researchers still need to identify a simple and reliable experimental method capable of providing accurate dynamic fracture toughness measurements. Further understanding of the failure phenomena (such as crack propagation, material instabilities, etc.) in advanced layered and nano-materials require the development of novel experimental techniques. The motivation of the present investigation is to establish a reliable experimental/computational procedure to obtain both accurate dynamic fracture toughness and crack dynamic propagation parameters.
DTIC

Structural Design; Design Analysis; Deformation

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GEOSCIENCES (GENERAL)

19990100629 Los Alamos National Lab., NM USA

Remote monitoring of volcanic gases using passive Fourier transform spectroscopy

Love, S. P.; Goff, F.; Counce, D.; Schmidt, S. C.; Siebe, C.; Dec. 31, 1999; 3p; In English; OSA topical conference

Report No.(s): DE99-002723; LA-UR-99-823; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Volcanic gases provide important insights on the internal workings of volcanoes and changes in their composition and total flux can warn of impending changes in a volcano's eruptive state. In addition, volcanoes are important contributors to the earth's atmosphere, and understanding this volcanic contribution is crucial for unraveling the effect of anthropogenic gases on the global climate. Studies of volcanic gases have long relied upon direct in situ sampling, which requires volcanologists to work on-site within a volcanic crater. In recent years, spectroscopic techniques have increasingly been employed to obtain information on volcanic gases from greater distances and thus at reduced risk. These techniques have included UV correlation spectroscopy (Cospec) for SO2 monitoring, the most widely-used technique, and infrared spectroscopy in a variety of configurations, both open- and closed- path. Francis et al. have demonstrated good results using the sun as the IR strong restrictions on the location of instrument and is thus best suited to more accessible volcanoes. In order to maximize the flexibility and range of FTIR measurements at volcanoes, work over the last few years has emphasized techniques which utilize the strong radiance contrast between the volcanic gas plume and the sky. The authors have successfully employed these techniques at several volcanoes, including the White Island and Ruapehu volcanoes in New Zealand, the Kilauea volcano on Hawaii, and Mt. Etna in Italy. But Popocatepetl (5452 m), the recently re-awakened volcano 70 km southeast of downtown Mexico City, has provided perhaps the best examples to date of the usefulness of these techniques.
NTIS

Volcanoes; Gas Analysis; Infrared Spectroscopy; Remote Sensing

19990103063 Florida Univ., Gainesville, FL USA

Three Dimensional Hydrodynamic Model for Stratified Flows in Lakes and Estuaries (HYDRO3D): Theory, User Guidance, and Applications for Superfund and Ecological Risk Assessments *Topical Report*

Sheng, Y. P.; Zakikhani, M.; McCutcheon, S. C.; Hosseinipour, E. Z.; Wang, P. F.; Jun. 1999; 234p; In English

Report No.(s): PB99-169898; EPA/600/R-99/049; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

The HYDRO3D program has been documented to aid in the simulation of lakes, harbors, coastal areas, and estuaries. HYDRO3D is a dynamic modeling system that can be used to simulate currents in water bodies as they respond to tides, winds, density gradients, river flows, and basin geometry and bathymetry. The code is a three-dimensional, time-dependent, o-stretched coordinate, free surface model that can be run in fully three-dimensional (3-D) mode, tow-dimensional vertically-averaged (x-y), and two-dimensional laterally-averaged x-z mode. The applications provided demonstrated that the model is capable of realistic simulation of flow and salinity transport in complex and dynamic water bodies. These applications include simulations of tidal circulation and salinity transport in Suisun Bay, California and Charlotte Harbor, Florida and wind-forced circulation in Green Bay, Lake Michigan. Tidal circulation in Prince William Sound, Alaska was investigated to determine the feasibility of applying the model under emergency conditions. Finally, the calibration of the model for the Mississippi Sound is illustrated.
NTIS

Hydrodynamics; Estuaries; Lakes; Environmental Cleanup; Stratified Flow

19990103118 Geological Survey, Water Resources Div., Trenton, NJ USA

Simulation of Ground-Water Flow and Movement of the Fresh water-Salt water Interface in the New Jersey Coastal Plain

Pope, D. A.; Gordon, A. D.; 1999; 176p; In English

Report No.(s): PB99-152480; USGS/WRI-98-4216; No Copyright; Avail: CASI; A02, Microfiche; A09, Hardcopy

   This report describes the hydrogeology of, ground-water flow system in, and fresh water-salt water interface movement in the New Jersey Coastal Plain sediments. The SHARP computer model (Essaid, 1990) is used to simulate the ground-water flow system, including the location and movement of the fresh water-salt water interface in nine aquifers and eight intervening confining units in the Coastal Plain. SHARP is a quasi-three-dimensional finite-difference ground-water flow model that simulates both freshwater and salt water flow separated by a sharp interface. The flow model is based on the USGS New Jersey Regional Aquifer-System Analysis (RASA) model (Martin, 1998) but has been modified to simulate flow to the seaward limit of the Continental Shelf and to include the salt water part of the flow system. Model design, boundary conditions, input data, calibration, and assumptions used in the simulations are described. The results of the simulations are used to estimate the location and movement of the fresh water-salt water interface resulting from (1) eustatic sea-level changes over the past 84,000 years, (2) ground-water withdrawals from Coastal Plain aquifers from 1896 through 1988, and (3) hypothetical ground-water withdrawals from 1988 to 2040.
NTIS

Ground Water; Water Flow; Fresh Water; Salts; Systems Analysis; Hydrogeology; Geological Surveys; Computerized Simulation; Coastal Plains

19990103120 Geological Survey, Water Resources Div., Trenton, NJ USA

Design and Analysis of Tracer Tests to Determine Effective Porosity and Dispersivity in Fractured Sedimentary Rocks, Newark Basin, New Jersey

Carleton, G. B.; Welty, C.; Buxton, H. T.; 1999; 92p; In English

Report No.(s): PB99-155475; USGS/WRI-98-4126; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

   Investigations of the transport and fate of contaminants in fractured-rock aquifers require knowledge of aquifer hydraulic and transport characteristics to improve prediction of the rate and direction of movement of contaminated ground water. This report describes an approach to estimating hydraulic and transport properties in fractured-rock aquifers; demonstrates the approach at a sedimentary fractured-rock site in the Newark Basin, N.J.; and provides values for hydraulic and transport properties at the site. The approach has three components: (1) characterization of the hydrogeologic framework of ground-water flow within the rock-fracture network, (2) estimation of the distribution of hydraulic properties (hydraulic conductivity and storage coefficient) within that framework, and (3) estimation of transport properties (effective porosity and dispersivity). The approach includes alternatives with increasingly complex data-collection and analysis techniques.
NTIS

Porosity; Sedimentary Rocks; Geology; Trace Elements

19990103121 Geological Survey, Water Resources Div., Lemoyne, PA USA

Age, Double Porosity, and Simple Reaction Modifications for the MOC3D Ground-Water Transport Model

Goode, D. J.; 1999; 46p; In English

Report No.(s): PB99-155483; USGS/WRI-99-4041; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

   This report describes modifications to a three-dimensional solute-transport model (MOC3D) developed by the US Geological Survey (USGS). These modifications expand the capabilities of MOC3D to simulate (1) age of water in an aquifer; (2) effects of double porosity on concentrations of a single solute, and (3) effects of decay and zero-order growth reactions on a single solute. These modifications are incorporated into MOC3D version 3.0. Although extensive testing of MOC3D indicates that this model will yield reliable calculations for a wide variety of field problems, the user is cautioned that the accuracy and efficiency of the model can be appreciably affected for certain combinations of values for parameters and boundary conditions.
NTIS

Porosity; Ground Water; Hydrology Models; Geological Surveys

19990103127 Environmental Protection Agency, Office of Water, Washington, DC USA

Catalog of Publications, Office of Science and Technology (Office of Water, Environmental Protection Agency) 1999 Edition

Aug. 1999; 88p; In English

Report No.(s): PB99-168940; EPA/820/B-99/001; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

Contents included are: Using the Catalog; Introduction to the Office of Science and Technology (OST); Industrial Effluent Limitations and Guidelines (Listed alphabetically by Point Source); Water Quality Standards; Ambient Water Quality Criteria; Biological Quality Criteria; Nutrient Criteria; Equilibrium Partitioning Sediment Guidelines (Sediment Quality Criteria); Drinking Water Criteria; Drinking Water Health Advisories; Water Quality Modeling and Total Maximum Daily Loads Guidance; Analytical Laboratory Methods; Contaminated Sediments; Fish Tissue Quality; Municipal Sewage Sludge; Great Lakes Guidance; Beach Water Quality; Pollution Prevention-IP3 Reports; Other; Videotapes; Datafiles and Software; and Index.
NTIS

Water Pollution; Environment Effects; Environment Protection; Water Resources; Great Lakes (North America); Environment Management; Water Quality; Pollution Control

19990103361 Los Alamos National Lab., NM USA
Forward-in-time differencing for fluids: Nonhydrostatic modeling of fluid motions on a sphere
Smolarkiewicz, P. K.; Grubisic, V.; Margolin, L. G.; Wyszogrodzki, A. A.; Dec. 31, 1998; 26p; In English
Report No.(s): DE99-002611; LA-UR-98-3791; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Traditionally, numerical models for simulating planetary scale weather and climate employ the hydrostatic primitive equations--an abbreviated form of Navier-Stokes' equations that neglect vertical accelerations and use simplified Coriolis forces. Although there is no evidence so far that including nonhydrostatic effects in global models has any physical significance for large scale solutions, there is an emerging trend in the community toward restoring Navier-Stokes' equations (or at least their less constrained forms) in global models of atmospheres and oceans. The primary motivation is that state-of-the-art computers already admit resolutions where local nonhydrostatic effects become noticeable. much of this present research aims to improve the design of a high-performance numerical model for simulating the flows of moist (and precipitating), rotating, stratified fluids past a specified time-dependent irregular lower boundary. This model is representative of a class of nonhydrostatic atmospheric codes that employs the anelastic equations of motion in a terrain-following curvilinear framework, and contains parallel implementations of semi-Lagrangian and Eulerian approximations selectable by the user. The model has been employed in a variety of application; the quality of results suggest that modern nonoscillatory forward-in-time (NFT) methods are superior to the more traditional centered-in-time-and-space schemes, in terms of accuracy, computational efficiency, flexibility and robustness. The authors have extended the Cartesian NFT model to a mountainous sphere and, consequently, have dispensed with the traditional geophysical simplifications of hydrostaticity, gentle terrain slopes, and weak rotation. In this paper, they discuss the algorithmic design, relative efficiency and accuracy of several different variants (hydrostatic, nonhydrostatic, implicit, explicit, etc.) of the NFT global model. They substantiate their theoretical discussions with the results of simulations of idealized global orographic flows and climates.
NTIS
Spheres; Rotating Fluids; Climate Models; Finite Difference Theory; Climatology

19990103935 Geological Survey, Water Resources Div., Rolla, MO USA
Water Resources Data for Missouri Water Year 1995 *Annual Report, (Annual) 1 Oct. 1994 - 30 Sep. 1995*
Hauck, H. S.; Nagel, C. D.; Huber, L. G.; Apr. 1999; 340p; In English
Report No.(s): PB99-170466; USGS/WDR/MO-95/1; No Copyright; Avail: CASI; A15, Hardcopy; A03, Microfiche

The U.S. Geological Survey, Water Resources Division, in corporation with local, State, and Federal agencies and organizations, obtains a large quantity of data pertaining to the water resources of Missouri each water year (October 1 to September 30). These data, accumulated during the water years, constitute a valuable data base for developing an improves understanding of the water resources of Missouri. Water-resources data for the 1995 water year for Missouri consist of records of stage, discharge, and water quality of streams; stage, contents, and water quality of lakes and reservoirs; and ground-water levels. This volume contains discharge records for 106 gaging stations; stage at 12 lakes and reservoirs; water quality at 53 sampling stations (including 2 lakes and reservoirs); and water-level records for 8 ground-water monitoring wells.
NTIS
Ground Water; Surface Water; Water Resources; Hydrology; Water Quality

19990104672 Forest Service, Pacific Northwest Research Station, Portland, OR USA
Land Use in Maine: Determinants of Past Trends and Projections of Future Changes *Topical Report*
Plantinga, A. J.; Mauldin, T.; Alig, R. J.; Jun. 1999; 32p; In English
Report No.(s): PB99-169005; FSRP-PNW-511; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The purpose of this report was to analyze past land use trends in Maine and, based on these results, develop projections of future land use. The immediate purpose of this work was to provide input to the US Department of Agriculture, Forest Service's

nationwide effort to assess future trends in the Nation's forest resources in accordance with the 1974 Resources Planning Act (RPA). The second section of this paper discusses past trends in land use in Maine and reviews previous studies of the determinants of land use. Empirical evidence and land use theory are brought together under 'An Econometric Model of Land Use'. In 'Projections of Land Use in Maine', projections are generated based on the estimation results of the econometric model section of this paper. Conclusions are contained in a final section.

NTIS

Land Use; Trends; Projection

19990105725 Geological Survey, Water Resources Div., Northborough, MA USA

Water Resources Data for Massachusetts and Rhode Island, Water Year 1998 *Annual Report, 1 Oct. 1997 - 30 Sep. 1998*

Socolow, R. S.; Comeau, L. Y.; Zanca, J. L.; Ramsbey, L. R.; Aug. 1999; 462p; In English

Report No.(s): PB99-168916; USGS/WDR/MA/RI-98/1; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

This report contains discharge records for 93 gaging stations, monthend contents of 4 lakes and reservoirs, water quality at 22 gaging stations, and water levels for 139 observation wells. Miscellaneous hydrologic data were collected at various sites that were not a part of the systematic data-collection program and are published as miscellaneous discharge measurements.

NTIS

Ground Water; Hydrology; Reservoirs; Data Acquisition

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EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography. For instrumentation see 35 Instrumentation and Photography.

19990100645 NASA Goddard Space Flight Center, Greenbelt, MD USA

Northern Forest Ecosystem Dynamics Using Coupled Models and Remote Sensing

Ranson, K. J., NASA Goddard Space Flight Center, USA; Sun, G., Maryland Univ., USA; Knox, R. G., NASA Goddard Space Flight Center, USA; Levine, E. R., NASA Goddard Space Flight Center, USA; Weishampel, J. F., University of Central Florida, USA; Fifer, S. T., Raytheon STX Corp., USA; Sep. 27, 1999; 30p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Forest ecosystem dynamics modeling, remote sensing data analysis, and a geographical information system (GIS) were used together to determine the possible growth and development of a northern forest in Maine, USA. Field measurements and airborne synthetic aperture radar (SAR) data were used to produce maps of forest cover type and above ground biomass. These forest attribute maps, along with a conventional soils map, were used to identify the initial conditions for forest ecosystem model simulations. Using this information along with ecosystem model results enabled the development of predictive maps of forest development. The results obtained were consistent with observed forest conditions and expected successional trajectories. The study demonstrated that ecosystem models might be used in a spatial context when parameterized and used with georeferenced data sets.

Author

Forests; Ecosystems; Environment Models; Biomass; Soil Mapping

19990100918 NASA Marshall Space Flight Center, Huntsville, AL USA

Remote Sensing in Geography in the New Millennium: Prospects, Challenges, and Opportunities

Quattrochi, Dale A., NASA Marshall Space Flight Center, USA; Jensen, John R., South Carolina Univ., USA; Morain, Stanley A., New Mexico Univ., USA; Walsh, Stephen J., North Carolina Univ., USA; Ridd, Merrill K., Utah Univ., USA; [1999]; 1p; In English, 23 Mar. 1999, Honolulu, HI, USA; Sponsored by Association of American Geographers, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Remote sensing science contributes greatly to our understanding of the Earth's ecosystems and cultural landscapes. Almost all the natural and social sciences, including geography, rely heavily on remote sensing to provide quantitative, and indispensable spatial information. Many geographers have made significant contributions to remote sensing science since the 1970s, including the specification of advanced remote sensing systems, improvements in analog and digital image analysis, biophysical modeling, and terrain analysis. In fact, the Remote Sensing Specialty Group (RSSG) is one of the largest specialty groups within the AAG with over 500 members. Remote sensing in concert with a geographic information systems, offers much value to geography as both an incisive spatial-analytical tool and as a scholarly pursuit that adds to the body of geographic knowledge on the whole. The "power" of remote sensing as a research endeavor in geography lies in its capabilities for obtaining synoptic, near-real time data

at many spatial and temporal scales, and in many regions of the electromagnetic spectrum - from microwave, to RADAR, to visible, and reflective and thermal infrared. In turn, these data present a vast compendium of information for assessing Earth attributes and characte6stics that are at the very core of geography. Here we revisit how remote sensing has become a fundamental and important tool for geographical research, and how with the advent of new and improved sensing systems to be launched in the near future, remote sensing will further advance geographical analysis in the approaching New Millennium.
Author
Remote Sensing; Geographic Information Systems; Ecosystems; Topography; Terrain Analysis

19990102425 NASA Goddard Space Flight Center, Greenbelt, MD USA
NASA/NOAA: Earth Science Electronic Theater 1999. Earth Science Observations, Analysis and Visualization: Roots in the 60s - Vision for the Next Millennium
Hasler, A. Fritz, NASA Goddard Space Flight Center, USA; 1999; 2p; In English; Hussey Memorial, 22 Apr. 1999, PA, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The Etheater presents visualizations which span the period from the original Suomi/Hasler animations of the first ATS-1 GEO weather satellite images in 1966, to the latest 1999 NASA Earth Science Vision for the next 25 years. Hot off the SGI-Onyx Graphics-Supercomputer are NASA''s visualizations of Hurricanes Mitch, Georges, Fran and Linda. These storms have been recently featured on the covers of National Geographic, Time, Newsweek and Popular Science. Highlights will be shown from the NASA hurricane visualization resource video tape that has been used repeatedly this season on National and International network TV. Results will be presented from a new paper on automatic wind measurements in Hurricane Luis from 1-min GOES images that appeared in the November BAMS. The visualizations are produced by the NASA Goddard Visualization & Analysis Laboratory, and Scientific Visualization Studio, as well as other Goddard and NASA groups using NASA, NOAA, ESA, and NASDA Earth science datasets. Visualizations will be shown from the Earth Science ETheater 1999 recently presented in Tokyo, Paris, Munich, Sydney, Melbourne, Honolulu, Washington, New York, and Dallas. The presentation Jan 11-14 at the AMS meeting in Dallas used a 4-CPU SGI/CRAY Onyx Infinite Reality Super Graphics Workstation with 8 GB RAM and a Terabyte Disk at 3840 X 1024 resolution with triple synchronized BarcoReality 9200 projectors on a 60ft wide screen. Visualizations will also be featured from the new Earth Today Exhibit which was opened by Vice President Gore on July 2, 1998 at the Smithsonian Air & Space Museum in Washington, as well as those presented for possible use at the American Museum of Natural History (NYC), Disney EPCOT, and other venues. New methods are demonstrated for visualizing, interpreting, comparing, organizing and analyzing immense HyperImage remote sensing datasets and three dimensional numerical model results. We call the data from many new Earth sensing satellites, HyperImage datasets, because they have such high resolution in the spectral, temporal, spatial, and dynamic range domains. The traditional numerical spreadsheet paradigm has been extended to develop a scientific visualization approach for processing HyperImage datasets and 3D model results interactively. The advantages of extending the powerful spreadsheet style of computation to multiple sets of images and organizing image processing were demonstrated using the Distributed Image SpreadSheet (DISS). The DISS is being used as a high performance testbed Next Generation Internet (NGI) VisAnalysis of: 1) El Nino SSTs and NDVI response 2) Latest GOES 10 5-min rapid Scans of 26 day 5000 frame movie of March & April 198 weather and tornadic storms 3) TRMM rainfall and lightning 4)GOES 9 satellite images/winds and NOAA aircraft radar of hurricane Luis, 5) lightning detector data merged with GOES image sequences, 6) Japanese GMS, TRMM, & ADEOS data 7) Chinese FY2 data 8) Meteosat & ERS/ATSR data 9) synchronized manipulation of multiple 3D numerical model views; etc. will be illustrated. The Image SpreadSheet has been highly successful in producing Earth science visualizations for public outreach.
Author
Computer Graphics; Earth Sciences; Image Processing; Projectors; Remote Sensing; Satellite Imagery; Scientific Visualization; Three Dimensional Models; Video Tapes; Meteorology; Earth Observations (From Space)

19990102605 NASA Goddard Space Flight Center, Greenbelt, MD USA
NASA's Experience with UV Remote Using SBUV and TOMS Instruments
Bhartia, P. K., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Atmospheric Measurements From Space, 6-22 Jan. 1999, Noordwijk, Netherlands; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

This paper will discuss key features of the NASA algorithm that has been used to produce several highly popular geophysical products from the Solar Backscatter Ultraviolet (SBUV) and Total Ozone Mapping Spectrometer (TOMS) series of instruments. Since these instruments have a limited number of wavelengths, many innovative algorithmic approaches have been developed over the years to derive maximum information from these sensors. We will use Global Ozone Monitoring Experiment (GOME) data to test the assumptions made in these algorithms and show what additional information is contained in the GOME hyperspec-

tral data. At NASA we are using this information to improve the SBUV and TOMS algorithms, as well as to develop more efficient algorithms to process GOME data.
Author

Algorithms; Data Processing; Image Processing; Computer Programs

19990102606 NASA Goddard Space Flight Center, Greenbelt, MD USA

Spin-Up time Scales of the Off-Line Land Surface GEOS Assimilation (OLGA) System

Houser, P., NASA Goddard Space Flight Center, USA; Yang, R., NASA Goddard Space Flight Center, USA; Bosilovich, M., NASA Goddard Space Flight Center, USA; Molod, A., NASA Goddard Space Flight Center, USA; Nebuda, S., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 79th, 10-15 Jan. 1998, Dallas, TX, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The spin-up time scale of a land surface model is the time that a model takes to arrive at its equilibrium state following initial anomalies in the land surface state with respect to a time series of atmospheric forcing conditions. A robust land surface model can adequately treat realistic anomaly initial conditions to arrive at a realistic equilibrium state. The characteristic spin-up time scales can be used to assess the robustness of land surface models, particularly with respect to the surface moisture and energy conservation. In this study we investigate the spin-up processes in the Off-line Land Surface GEOS Assimilation (OLGA) system. OLGA is a global version of the Mosaic land surface model (LSM) coupled with near surface atmosphere through a turbulence scheme used in the GEOS Data Assimilation System (DAS) at the Data Assimilation Office, NASA-GSFC. We examine the spin-up time scales in a 20-year long perpetual 1992 OLGA integration. The GEOS-DAS 1992 data provided all surface atmospheric forcing. The initial conditions of land surface state were interpolated from the climatology of a general circulation model coupled with the Mosaic LSM. Also, a similar 20-year long perpetual 1992 OLGA integration was performed using an observationally based surface downward longwave and shortwave radiation as a forcing condition. The results show that the spin-up time scale required by the OLGA to arrive at its thermal equilibrium state is much shorter than that required for hydrological equilibrium. The spin-up time scale of available soil moisture varies globally and depends on initial soil moisture anomaly. Almost all the grid points with long spin-up time scales are located poleward of 50N. The factors determining the spin-up time scales will be investigated.
Author

Data Systems; Time Series Analysis; Dynamic Models; Steady State; Systems Stability; Thermodynamic Equilibrium; Earth Surface; Hydrology

19990102876 Naval Research Lab., Marine Geosciences Div., Stennis Space Center, MS USA

Software Requirements Specification of National Imagery and Mapping Agency Mapping, Charting and Geodesy Utility Software Environment (NIMAMUSE) Fusion V2.1 *Final Report*

Landrum, Jerry L.; Ramsey, Susan H.; Jun. 25, 1998; 15p; In English

Report No.(s): AD-A366349; NRL/MR/7441--98-8088; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

NIMAMUSE Fusion V2.1 is a computer mapping software program produced by the Naval Research Laboratory for the National Imagery and Mapping Agency (NIMA). In addition to demonstrating the NIMA digital map data products, coordinate conversions, and datum transformations, Fusion provides general purpose mapping capabilities for managing user data, route planning, and route monitoring. This report presents the software requirements for Fusion V2.1.
DTIC

Imagery; Computer Programming; Computer Aided Mapping; Geodesy; Software Engineering; Multisensor Fusion

19990102881 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Model for Estimating Crop Yield by Difference Vegetation Index *Model Estimasi Produksi Tanaman Padi Berdasarkan Indeks Vegetasi*

Parwati, Ety, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Prasasti, Indah, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Arief, Hamzah, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Harsanugraha, Wawan K., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Harini, Sri, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Effendy, Iskandar, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Suhartini, Titin, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Nugroho, dan Gagat, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; January 1999; ISSN 0126-0480; Volume 1, No. 1, pp. 37-47; In Malay-Indonesian; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Such forecasting model developed by NDVI (Normalized Difference Vegetation Index) value from remote sensing satellite data can give estimation of crop yield. In this research we verified some estimation models with NOAA-AVHRR (National

Oceanic and atmospheric Administration - Advanced Very High Resolution Radiometer) data. The purpose was the best model with high correlation between NDVI and crop yield. The evaluation of that models was in linear, nonlinear and or multiple linear. The NOAA-AVHRR data used for this research were retrieved in April 1995 until November 1997, only 3 until 5 plantation season. The NDVI value for getting such best model should represent the phase of rice plant growth. There were NDVI in the 3rd week (NDVI-3), NDVI-8, NDVI-10, NDVI-12 and NDVI in the maximum rice plant growth. For minimal condition of points in statistics, we took the different point in a different district as a point for that regency.

Author

Yield; Farm Crops; Vegetative Index; Vegetation Growth

19990102920 NASA Goddard Space Flight Center, Greenbelt, MD USA

Angular and Seasonal Variation of Spectral Surface Reflectance Ratios: Implications for the Remote Sensing of Aerosol over Land

Remer, L. A., NASA Goddard Space Flight Center, USA; Wald, A. E., Science Applications International Corp., USA; Kaufman, Y. J., NASA Goddard Space Flight Center, USA; Aug. 30, 1999; 35p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We obtain valuable information on the angular and seasonal variability of surface reflectance using a hand-held spectrometer from a light aircraft. The data is used to test a procedure that allows us to estimate visible surface reflectance from the longer wavelength 2.1 micrometer channel (mid-IR). Estimating or avoiding surface reflectance in the visible is a vital first step in most algorithms that retrieve aerosol optical thickness over land targets. The data indicate that specular reflection found when viewing targets from the forward direction can severely corrupt the relationships between the visible and 2.1 micrometer reflectance that were derived from nadir data. There is a month by month variation in the ratios between the visible and the mid-IR, weakly correlated to the Normalized Difference Vegetation Index (NDVI). If specular reflection is not avoided, the errors resulting from estimating surface reflectance from the mid-IR exceed the acceptable limit of DELTA-rho approximately 0.01 in roughly 40% of the cases, using the current algorithm. This is reduced to 25% of the cases if specular reflection is avoided. An alternative method that uses path radiance rather than explicitly estimating visible surface reflectance results in similar errors. The two methods have different strengths and weaknesses that require further study.

Author

Annual Variations; Spectral Reflectance; Surface Properties; Remote Sensing; Aerosols

19990102991 Physics and Electronics Lab. TNO, The Hague, Netherlands

SAR for Surveillance and Reconnaissance *SAR voor surveillance en reconnaissance*

vanHalsema, D., Physics and Electronics Lab. TNO, Netherlands; Dekker, R. J., Physics and Electronics Lab. TNO, Netherlands; Groeneveld, A. W., Physics and Electronics Lab. TNO, Netherlands; Groot, J. S., Physics and Electronics Lab. TNO, Netherlands; Otten, M. P. G., Physics and Electronics Lab. TNO, Netherlands; February 1998; 67p; In Dutch; Original contains color illustrations

Contract(s)/Grant(s): TNO Proj. 26490

Report No.(s): TD97-0371; FEL-97-A318; Copyright; Avail: Issuing Activity, Hardcopy

In this report a number of items relevant for reconnaissance are evaluated against typical nowadays specifications of airborne Synthetic Aperture Radar (SAR) systems. Attention is paid to developments in hardware and signal processing for SAR and their relevance to surveillance and reconnaissance. These new developments are: high resolution SAR, polarimetric SAR, Moving Target Indication techniques, interferometric SAR, speckle reduction techniques and change detection. Furthermore a literature survey into automatic target recognition using SAR has been conducted and is reported.

Author

Synthetic Aperture Radar; Evaluation; Hardware; Fabrication; Signal Processing

19990103012 NASA Goddard Space Flight Center, Greenbelt, MD USA

Carbon-Water-Energy Relations for Selected River Basins

Choudhury, B. J., NASA Goddard Space Flight Center, USA; [1998]; 1p; In English, 6-10 Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A biophysical process-based model was run using satellite, assimilated and ancillary data for four years (1987-1990) to calculate components of total evaporation (transpiration, interception, soil and snow evaporation), net radiation, absorbed photosynthetically active radiation and net primary productivity over the global land surface. Satellite observations provided fractional vegetation cover, solar and photosynthetically active radiation incident of the surface, surface albedo, fractional cloud cover, air temperature and vapor pressure. The friction velocity and surface air pressure are obtained from a four dimensional data assimila-

tion results, while precipitation is either only surface observations or a blended product of surface and satellite observations. All surface and satellite data are monthly mean values; precipitation has been disaggregated into daily values. All biophysical parameters of the model are prescribed according to published records. From these global land surface calculations results for river basins are derived using digital templates of basin boundaries. Comparisons with field observations (micrometeorologic, catchment water balance, biomass production) and atmospheric water budget analysis for monthly evaporation from six river basins have been done to assess errors in the calculations. Comparisons are also made with previous estimates of zonal variations of evaporation and net primary productivity. Efficiencies of transpiration, total evaporation and radiation use, and evaporative fraction for selected river basins will be presented.

Author

Biophysics; Carbon; Water Balance; Evaporation; River Basins

19990103013 NASA Goddard Space Flight Center, Greenbelt, MD USA

Parameterization of Vegetation Aerodynamic Roughness of Natural Regions Satellite Imagery

Jasinski, Michael F., NASA Goddard Space Flight Center, USA; Crago, Richard, Illinois Univ., USA; Stewart, Pamela, University of Southern Oregon, USA; [1998]; 1p; In English, 6-10 Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Parameterizations of the frontal area index and canopy area index of natural or randomly distributed plants are developed, and applied to the estimation of local aerodynamic roughness using satellite imagery. The formulas are expressed in terms of the subpixel fractional vegetation cover and one non-dimensional geometric parameter that characterizes the plant's shape. Geometrically similar plants and Poisson distributed plant centers are assumed. An appropriate averaging technique to extend satellite pixel-scale estimates to larger scales is provided. The parameterization is applied to the estimation of aerodynamic roughness using satellite imagery for a 2.3 sq km coniferous portion of the Landes Forest near Lubbon, France, during the 1986 HAPEX-Mobilhy Experiment. The canopy area index is estimated first for each pixel in the scene based on previous estimates of fractional cover obtained using LANDSAT Thematic Mapper imagery. Next, the results are incorporated into Raupach's (1992, 1994) analytical formulas for momentum roughness and zero-plane displacement height. The estimates compare reasonably well to reference values determined from measurements taken during the experiment and to published literature values. The approach offers the potential for estimating regionally variable, vegetation aerodynamic roughness lengths over natural regions using satellite imagery when there exists only limited knowledge of the vegetated surface.

Author

Parameterization; Vegetation; Roughness

19990103014 NASA Goddard Space Flight Center, Greenbelt, MD USA

Influence of Soil Heterogeneity on Mesoscale Land Surface Fluxes During Washita '92

Jasinski, Michael F., NASA Goddard Space Flight Center, USA; Jin, Hao, Science Systems and Applications, Inc., USA; [1998]; 1p; In English; Studies of Subgrid Spatial Variabilities, 6-10 Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The influence of soil heterogeneity on the partitioning of mesoscale land surface energy fluxes at diurnal time scales is investigated over a 10(exp 6) sq km domain centered on the Little Washita Basin, Oklahoma, for the period June 10 - 18, 1992. The sensitivity study is carried out using MM5/PLACE, the Penn State/NCAR MM5 model enhanced with the Parameterization for Land-Atmosphere-Cloud Exchange or PLACE. PLACE is a one-dimensional land surface model possessing detailed plant and soil water physics algorithms, multiple soil layers, and the capacity to model subgrid heterogeneity. A series of 12-hour simulations were conducted with identical atmospheric initialization and land surface characterization but with different initial soil moisture and texture. A comparison then was made of the simulated land surface energy flux fields, the partitioning of net radiation into latent and sensible heat, and the soil moisture fields. Results indicate that heterogeneity in both soil moisture and texture affects the spatial distribution and partitioning of mesoscale energy balance. Spatial averaging results in an overprediction of latent heat flux, and an underestimation of sensible heat flux. In addition to the primary focus on the partitioning of the land surface energy, the modeling effort provided an opportunity to examine the issue of initializing the soil moisture fields for coupled three-dimensional models. For the present case, the initial soil moisture and temperature were determined from off-line modeling using PLACE at each grid box, driven with a combination of observed and assimilated data fields.

Author

Soils; Heterogeneity; Soil Moisture; Earth Surface; Mesoscale Phenomena

19990103015 NASA Goddard Space Flight Center, Greenbelt, MD USA
Application of the Shuttle Laser Altimeter in an Accuracy Assessment of Global 1-Kilometer Digital Elevation Data
Harding, David J., NASA Goddard Space Flight Center, USA; Carabajal, Claudia C., NVI, Inc., USA; Luthcke, Scott B., Raytheon, USA; Gesch, Dean B., USGS EDC, USA; [1998]; 1p; In English, 6-8 Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Shuttle Laser Altimeter (SLA) data have been used to evaluate the accuracy of GTOPO30, the first comprehensive, 1 km resolution, global topographic data set. GTOPO30 was developed by the USGS Eros Data Center (EDC), in part, to address NASA's needs for a global topographic model in support of remote sensing instruments aboard the Earth Observing System AM-1 spacecraft. SLA flew as a part of the STS-72 mission in January, 1996 observing the latitude band from +/- 28.5 deg, and on STS-85 in August, 1997 extending the observations to +/- 57 deg. Combining the SLA ranging data with shuttle position and pointing knowledge yields surface elevation data of very high vertical accuracy in an Earth-centered, absolute reference frame (2.8 m rms difference for SLA-01 with respect to ocean reference surface). Use of the well-determined mean sea surface reference for calibration allows propagation of high accuracy altimetry onto the continents. 436,635 SLA-01 land elevations were compared to the GTOPO30 grid after conversion to a mean sea level vertical datum using the Earth Geoid Model 96, jointly developed by Goddard and NIMA. The comparison reveals systematic elevation biases in southern Asia, Africa, Australia, and south America on the order 10's to 100 meters in the GTOPO30 compilation on spatial scales of 100's to 1000's of kilometers. These biases are likely due to vertical datum errors in the topographic source materials used to compile GTOPO30, which primarily consist of Defense Mapping Agency (DMA) digital elevation and topographic map products. These biases imply that elevation corrections applied to land gravity measurements using these DMA source materials will be biased, leading to errors in geoid models incorporating these land gravity data.
Author
Elevation; Altimetry; Laser Altimeters; Spacecraft Instruments; Laser Applications; Airborne Lasers; Geoids

19990103109 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Laser Vegetation Imaging Sensor (LVIS): An Airborne Laser Altimeter for Mapping Vegetation and Topography
Bryan, J., NASA Goddard Space Flight Center, USA; Rabine, David L., Science Systems and Applications, Inc., USA; [1998]; 1p; In English, 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA
Contract(s)/Grant(s): RTOP 259-20; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Laser Vegetation Imaging Sensor (LVIS) is an airborne laser altimeter designed to quickly and extensively map surface topography as well as the relative heights of other reflecting surfaces within the laser footprint. Since 1997, this instrument has primarily been used as the airborne simulator for the Vegetation Canopy Lidar (VCL) mission, a spaceborne mission designed to measure tree height, vertical structure and ground topography (including sub-canopy topography). LVIS is capable of operating from 500 m to 10 km above ground level with footprint sizes from 1 to 60 m. Laser footprints can be randomly spaced within the 7 degree telescope field-of-view, constrained only by the operating frequency of the ND:YAG Q-switched laser (500 Hz). A significant innovation of the LVIS altimeter is that all ranging, waveform recording, and range gating are performed using a single digitizer, clock base, and detector. A portion of the outgoing laser pulse is fiber-optically fed into the detector used to collect the return signal and this entire time history of the outgoing and return pulses is digitized at 500 Msamp/sec. The ground return is then located using software digital signal processing, even in the presence of visibly opaque clouds. The surface height distribution of all reflecting surfaces within the laser footprint can be determined, for example, tree height and ground elevation. To date, the LVIS system has been used to monitor topographic change at Long Valley caldera, CA, as part of NASA's Topography and Surface Change program, and to map tree structure and sub-canopy topography at the La Selva Biological Research Station in Costa Rica, as part of the pre-launch calibration activities for the VCL mission. We present results that show the laser altimeter consistently and accurately maps surface topography, including sub-canopy topography, and vegetation height and structure. These results confirm the measurement concept of VCL and highlight the benefits of airborne prototypes of spaceborne instruments.
Author
Canopies (Vegetation); Trees (Plants); Vegetation; Vegetative Index; Vegetation Growth; Imaging Techniques; Thematic Mapping; Topography

19990103142 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Comparison of FIFE Observation with GEOS Assimilated Data Including a Heterogeneous LSM
Bosilovich, M., Universities Space Research Association, USA; Houser, Paul, NASA Goddard Space Flight Center, USA; Molod, Andrea, NASA Goddard Space Flight Center, USA; Nebuda, Sharon, NASA Goddard Space Flight Center, USA; [1999]; 1p; In English; Hydrology, Feb. 1999, Dallas, TX, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Several recent studies have shown that much can be learned by comparing grid-point data from a data assimilation system with in-situ observations from field experiments. While the surface heterogeneity is acknowledged in these studies, they lack quantitative representations of the influence of heterogeneity on the near-surface meteorology and surface hydrologic and energy balance. Here, we use the Betts and Ball FIFE site-averaged data. Standard deviations of the site-average will provide an estimate of the FIFE site heterogeneity. Recently, the Mosaic Land-Surface Model (LSM) has been incorporated into the Goddard Earth Observing System (GEOS) Data Assimilation System (DAS). The Mosaic LSM computes the surface energy and hydrologic balance for nine distinct surface types at each grid-point. Each surface type is proportionally weighted to determine the mean grid point properties. Hence, we can compare modeled and observed grid-point variability in addition to the mean properties. Also, assimilated data sets created with and without the LSM are compared. The results indicate the importance of including quantitative estimates of heterogeneity in the analysis of the land surface hydrology and energy balances in assimilation systems.
Author

Hydrology; Meteorology; Energy Budgets; Earth Surface; Surface Energy

19990103600 NASA Goddard Space Flight Center, Greenbelt, MD USA
Mapping Vegetation Structure in Kakadu National Park: An AIRSAR and GIS Application in Conservation
Imhoff, Marc L., NASA Goddard Space Flight Center, USA; Sisk, Thomas D., University of Northern Arizona, USA; Hampton, Haydee, Geological Survey, USA; Milne, Anthony K., New South Wales Univ., Australia; 1999; 1p; In English; US-Australia AIRSAW PACRIM Significant Results, 24-26 Aug. 1999, Maui, HI, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Airborne Synthetic Aperture Radar (AIRSAR) data were used to map vegetation structure in Kakadu National Park Australia as part of the PACRIM project. SAR data were co-registered with LANDSAT TM, aerial photos, and map data in a geographic information system for a small test area consisting of mangrove, floodplain grasslands, lowland tropical evergreen forest and upland mixed deciduous and evergreen tropical forest near the South Alligator River. LANDSAT (Thematic Mapper) TM very clearly showed the floristic composition and burn scars from the previous years fires and the AIRSAR data provided a profile of vegetation structure. Extensive field data on vegetation species composition and structure were collected across a series of transects in cooperation with a survey of avifauna in an effort to link the habitat edge structure with bird species responses. A test site was found that contained two types of habitat edges: 1) A structure specific edge - characterized by the appearance of a very strong structural change in the forest canopy occurring in the absence of a substantial turnover in floristics. 2) Floristic edge - a sharp transition in vegetation genetic composition with a mixed set of structural changes. Specific polarization combinations were selected that were highly correlated to a set of desired structural parameters found in the field data. Classification routines were employed to group radar pixels into 3 structural classes based on: the Surface Area to Volume ratio (SA/V) of the stems, the SA/V of the branches, and the leaf area index of the canopy. Separate canopy structure maps were then entered into the GIS and bird responses were observed relative to the classes and their boundaries. Follow-on work will consist of extending this approach to neighboring areas, generating structure maps, predicting bird responses across the edges, and make accuracy assessments.
Author

Aerial Photography; Airborne Equipment; Australia; Canopies (Vegetation); Geographic Information Systems; LANDSAT Satellites; Vegetation; Surveys

19990104286 NASA Goddard Space Flight Center, Greenbelt, MD USA
Interannual Variability of the Mosaic Land-Surface Model
Bosilovich, Michael G., NASA Goddard Space Flight Center, USA; Houser, Paul R., NASA Goddard Space Flight Center, USA; Schubert, Siegfried, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Reanalysis, 23-27 Aug. 1999, Reading, UK; Sponsored by European Centre for Medium-Range Weather Forecasts, UK; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recently, NASA Goddard Earth Observing System (GEOS-1) reanalysis data has been used to provide forcing for the Koster and Suarez Mosaic Land-surface Model (LSM). The LSM was integrated off-line at all global land points for the period of 1983 - 1995 by the Off-line Land- surface GEOS Assimilation system (OLGA). Here, we compare the interannual variability of OLGA, GEOS-1 and surface observing stations temperature and moisture. Particular attention is given to the USA because of the extreme seasons of 1988 and 1993. Furthermore, the comparison of OLGA is extended to include the analysis of data on the'tiles' (different surface types) in the Mosaic LSM. Results indicate that the GEOS-1 near-surface temperature and moisture reasonably represents the interannual variability in more normal years. However, OLGA also simulates the extreme drought and floods years well. The analysis of the tile information shows that the "Bare soil" surface type is most sensitive to the climate extremes. Off-line testing

has provided valuable information on the performance of the Mosaic LSM prior to its incorporation into the new version of the GEOS Data Assimilation System and the integration of a new long reanalysis.
Author

Data Systems; Earth Surface; Models; Surface Temperature; Moisture

19990104378 NASA Goddard Space Flight Center, Greenbelt, MD USA

Validation of Land-Surface Mosaic Heterogeneity in the GEOS DAS

Bosilovich, Michael G., NASA Goddard Space Flight Center, USA; Molod, Andrea, NASA Goddard Space Flight Center, USA; Houser, Paul R., NASA Goddard Space Flight Center, USA; Schubert, Siegfried, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Reanalysis, 23-27 Aug. 1999, Reading, UK; Sponsored by European Centre for Medium-Range Weather Forecasts, UK; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Mosaic Land-surface Model (LSM) has been included into the current GEOS Data Assimilation System (DAS). The LSM uses a more advanced representation of physical processes than previous versions of the GEOS DAS, including the representation of sub-grid heterogeneity of the land-surface through the Mosaic approach. As a first approximation, Mosaic assumes that all similar surface types within a grid-cell can be lumped together as a single'tile'. Within one GCM grid-cell, there might be 1 - 5 different tiles or surface types. All tiles are subjected to the grid-scale forcing (radiation, air temperature and specific humidity, and precipitation), and the sub-grid variability is a function of the tile characteristics. In this paper, we validate the LSM sub-grid scale variability (tiles) using a variety of surface observing stations from the Southern Great Plains (SGP) site of the Atmospheric Radiation Measurement (ARM) Program. One of the primary goals of SGP ARM is to study the variability of atmospheric radiation within a G,CM grid-cell. Enough surface data has been collected by ARM to extend this goal to sub-grid variability of the land-surface energy and water budgets. The time period of this study is the Summer of 1998 (June I - September 1). The ARM site data consists of surface meteorology, energy flux (eddy correlation and bowen ratio), soil water observations spread over an area similar to the size of a G-CM grid-cell. Various ARM stations are described as wheat and alfalfa crops, pasture and range land. The LSM tiles considered at the grid-space (2 x 2.5) nearest the ARM site include, grassland, deciduous forests, bare soil and dwarf trees. Surface energy and water balances for each tile type are compared with observations. Furthermore, we will discuss the land-surface sub-grid variability of both the ARM observations and the DAS.
Author

Earth Surface; Heterogeneity; Models; Data Base Management Systems; Atmospheric Radiation; Radiation Measurement; Proving

19990104390 Norwegian Defence Research Establishment, Kjeller, Norway

Analysis of Satellite SAR Images for Change Detection over Land Areas

Weydahl, D. J.; Jun. 1998; 254p; In English

Report No.(s): PB99-172520; FFI/PUB-98/04969; No Copyright; Avail: CASI; A03, Microfiche; A12, Hardcopy

The main objective of this work is to develop methods for detecting and analyzing satellite SAR backscatter changes observed over land areas. Backscatter changes are evaluated as a function of time, type of ground surface cover, SAR aspect angles, SAR incidence angles and image types. Both SAR amplitude images and interferometric SAR coherence images are used. The methods are applied on real spaceborne SAR data that are processed and distributed from Tromsoe Satellite Station in Norway. This means more specifically that SAR image products from the ERS-1, ERS-2 and RADARSAT satellites are studied in detail. The test areas are located in southern Norway and on Svalbard, and the surface cover categories include: agricultural fields, forested areas, lakes, urban areas, mountainous regions, snow-covered landscape and glaciers. Ground truth from the test areas are obtained from maps, aerial photos, optical satellite images, field observations and meteorological recordings.
NTIS

Satellite Imagery; Change Detection; Radar Imagery; Image Analysis

19990104598 NASA Goddard Space Flight Center, Greenbelt, MD USA

How to Estimate Attitude from Vector Observations

Markley, F. Landis, NASA Goddard Space Flight Center, USA; Mortari, Daniele, Rome Univ., Italy; [1999]; 17p; In English; Astrodynamics Specialist, 16-19 Aug. 1999, Girdwood, AK, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The most robust estimators minimizing Wahba's loss function are Davenport's q method and the Singular Value Decomposition (SVD) method. The q method is faster than the SVD method with three or more measurements. The other algorithms are less robust since they solve the characteristic polynomial equation to find the maximum eigenvalue of Davenport's K matrix. They are only preferable when speed or processor power is an important consideration. Of these, Fast Optimal Attitude Matrix (FOAM) is the most robust and faster than the q method. Robustness is only an issue for measurements with widely differing accuracies,

so the fastest algorithms, Quaternion ESTimator (QUEST), EStimator of the Optimal Quaternion (ESOQ), and ESOQ2, are well suited to star sensor applications.
Derived from text
Attitude (Inclination); Robustness (Mathematics); Statistical Analysis

19990105890 NASA Goddard Inst. for Space Studies, New York, NY USA
Bidirectional Reflectance of a Macroscopically Flat, High-Albedo Particulate Surface: An Efficient Radiative Transfer Solution and Applications to Regoliths
Mishchenko, Michael I., NASA Goddard Inst. for Space Studies, USA; Zakharova, Nadia T., Science Systems and Applications, Inc., USA; 1999; 1p; In English; Asteroids, Comets, Meteors, 25-30 Jul 1999, Ithaca, NY, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Many remote sensing applications rely on accurate knowledge of the bidirectional reflection function (BRF) of surfaces composed of discrete, randomly positioned scattering particles. Theoretical computations of BRFs for plane-parallel particulate layers are usually reduced to solving the radiative transfer equation (RTE) using one of existing exact or approximate techniques. Since semi-empirical approximate approaches are notorious for their low accuracy, violation of the energy conservation law, and ability to produce unphysical results, the use of numerically exact solutions of RTE has gained justified popularity. For example, the computation of BRFs for macroscopically flat particulate surfaces in many geophysical publications is based on the adding-doubling (AD) and discrete ordinate (DO) methods. A further saving of computer resources can be achieved by using a more efficient technique to solve the plane-parallel RTE than the AD and DO methods. Since many natural particulate surfaces can be well represented by the model of an optically semi-infinite, homogeneous scattering layer, one can find the BRF directly by solving the Ambartsumian's nonlinear integral equation using a simple iterative technique. In this way, the computation of the internal radiation field is avoided and the computer code becomes highly efficient and very accurate and compact. Furthermore, the BRF thus obtained fully obeys the fundamental physical laws of energy conservation and reciprocity. In this paper, we discuss numerical aspects and the computer implementation of this technique, examine the applicability of the Henyey-Greenstein phase function and the sigma-Eddington approximation in BRF and flux calculations, and describe sample applications demonstrating the potential effect of particle shape on the bidirectional reflectance of flat regolith surfaces. Although the effects of packing density and coherent backscattering are currently neglected, they can also be incorporated. The FORTRAN implementation of the technique is available on the World Wide Web, and can be applied to a wide range of remote sensing problems. BRF computations for undulated (macroscopically rough) surfaces are more complicated and often rely on time consuming Monte Carlo procedures. This approach is especially inefficient for optically thick, weakly absorbing media (e.g., snow and desert surfaces at visible wavelengths since a photon may undergo many internal scattering events before it exists the medium or is absorbed. However, undulated surfaces can often be represented as collections of locally flat tilted facets characterized by the BRF found from the traditional plane parallel RTE. In this way the MOnte Carlo procedure could be used only to evaluate the effects of surface shadowing and multiple surface reflections, thereby bypassing the time-consuming ray tracing inside the medium and providing a great savings of CPU time.
Author
Albedo; Bidirectional Reflectance; Flat Surfaces; Monte Carlo Method; Particulates; Radiative Transfer; Regolith; Remote Sensing; Spectral Reflectance

<div align="center">

44
ENERGY PRODUCTION AND CONVERSION

</div>

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower. For related information see also 07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power, and 28 Propellants and Fuels.

19990099732 NASA Marshall Space Flight Center, Huntsville, AL USA
Fresnel Lens Solar Concentrator Design Based on Geometric Optics and Blackbody Radiation Equations
Watson, Michael D., NASA Marshall Space Flight Center, USA; Jayroe, Robert, Jr., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Renewable and Advanced Energy Systems, 11-15 Apr. 1999, Maui, HI, USA
Contract(s)/Grant(s): RTOP 242-73-10; No Copyright; Avail: Issuing Activity, Hardcopy

Fresnel lenses have been used for years as solar concentrators in a variety of applications. Several variables effect the final design of these lenses including: lens diameter, image spot distance from the lens, and bandwidth focused in the image spot. Defining the image spot as the geometrical optics circle of least confusion and applying blackbody radiation equations the spot energy distribution can be determined. These equations are used to design a fresnel lens to produce maximum flux for a given spot size,

lens diameter, and image distance. This approach results in significant increases in solar efficiency over traditional single wave-length designs.

Author

Black Body Radiation; Fresnel Lenses; Geometrical Optics; Lens Design; Solar Collectors

19990100606 Department of Energy, Office of Financial Management and Controller, Washington, DC USA

Development and evaluation of sealing technologies for photovoltaic panels

Glass, S. J.; Hosking, F. M.; Baca, P. M.; Jul. 31, 1998; 61p; In English

Report No.(s): DE98-006277; SAND-98-1461; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

This report summarizes the results of a study to develop and evaluate low temperature glass sealing technologies for photovoltaic applications. This work was done as part of Cooperative Research and Development Agreement (CRADA) No. SC95/01408. The sealing technologies evaluated included low melting temperature glass frits and solders. Because the glass frit joining required a material with a melting temperature that exceeded the allowable temperature for the active elements on the photovoltaic panels, a localized heating scheme was required for sealing the perimeter of the glass panels. Thermal and stress modeling were conducted to identify the feasibility of this approach and to test strategies designed to minimize heating of the glass panel away from its perimeter. Hardware to locally heat the glass panels during glass frit joining was designed, fabricated, and successfully tested. The same hardware could be used to seal the glass panels using the low temperature solders. Solder adhesion to the glass required metal coating of the glass. The adhesion strength of the solder was dependent on the surface finish of the glass. Strategies for improving the polyisobutylene (PIB) adhesive currently being used to seal the panels and the use of Parylene coatings as a protective sealant deposited on the photovoltaic elements were also investigated. Starting points for further work are included.

NTIS

Sealing; Panels; Photovoltaic Cells

19990102411 NASA Marshall Space Flight Center, Huntsville, AL USA

Photovoltaics Using In Situ Resource Utilization for HEDS

Criswell, David R., Houston Univ., USA; Curreri, Peter A., NASA Marshall Space Flight Center, USA; 1998; In English; Space 1998 Engineering, Construction and Operations in Space, 26-30 apr. 1998, Albuquerque, NM, USA; Sponsored by American Society of Civil Engineers; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

One of the most important elements of a human planetary base is power production. Lunar data make it clear that several types of solar-to-electric converters can be manufactured on the Moon. Materials research and processing demonstrations are suggested that can be carried out on Earth, the Space Transportation System (STS), the International Space Station (ISS), and on the Moon to advance the in situ production of solar-to-electric power systems on the Moon. Many of the technologies will be applicable to Mars, the silicate moons, and asteroids.

Author

Photovoltaic Conversion; Photovoltaic Effect; Solar Arrays; Spacecraft Power Supplies; International Space Station; Space Transportation System

19990103052 Department of Energy, Federal Energy Technology Center, Washington, DC USA

Fuel Cells for the 21st Century: Collaboration for a Leap in Efficiency and Cost Reduction

1999; 20p; In English; Original contains color illustrations

Report No.(s): PB99-165284; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

To determine interest in a new collaborative program, a workshop on Next Generation Fuel Cells was hosted by the US Department of Energy (DOE) Federal Energy Technology Center (FETC) in November 1998. The workshop brought together over 100 participants, representing over 70 organizations from stakeholder groups: end users, utilities, industries, universities, national laboratories, government and other not-for-profit organizations. The goal of the workshop was to collaboratively address several questions: Are systems with efficiencies greater than 80 percent a good target, and what are the concept to explore them; If these concepts are a good target, what are the technology or market barriers to them, and what are priority research and development (R&D) topics that address these barriers; How can we act collaboratively to address the opportunities for these next-generation systems.

NTIS

Fuel Cells; Energy Technology; Cost Reduction; Research and Development

19990103058 National Renewable Energy Lab., Golden, CO USA

Current Status of Health and Safety Issues of Sodium/Metal Chloride (Zebra) Batteries

Trickett, David, National Renewable Energy Lab., USA; Dec. 15, 1998; 93p; In English

Report No.(s): DE00-007101; NREL/TP-460-25553; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

This report addresses environmental, health, and safety (EH&S) issues associated with sodium/ metal chloride batteries, in general, although most references to specific cell or battery types refer to units developed or being developed under the Zebra trademark. The report focuses on issues pertinent to sodium/metal chloride batteries and their constituent components; however, the fact that some 'issues' arise from interaction between electric vehicle (EV) and battery design com- pels occasional discussion amid the context of EV vehicle design and operation. This approach has been chosen to provide a reasonably comprehensive account of the topic from a cell technology perspective and an applications perspective.

NTIS

Electric Batteries; Health; Electric Motor Vehicles; Sodium Chlorides; Hazards

19990103119 Environmental Protection Agency, Office of Pollution Prevention and Technology Development, Sacramento, CA USA

Environmental Technology Verification Report: Rechargeable Alkaline Household Battery System, Rayovac Corpora- tion, Renewal (Trade Name)

Escarda, T.; Lewis, N.; Mar. 1999; 56p; In English

Report No.(s): PB99-155442; EPA/600/R-99/005; No Copyright; Avail: National Technical Information Service (NTIS), Hard- copy

The EPA's ETV Program, in partnership with recognized testing organizations, objectively and systematically documents the performance of commercial ready technologies. Together, with the full participation of the technology developer, develop plans, conduct tests, collect and analyze data, and report findings. Rayovac redesigned their alkaline household batteries so that they could be recharged. The additional charge cycles extend battery life by increasing the energy capacity, which benefits the environ- ment by generating less waste. The design changes include increased void space, and addition of lead and silver. The Rayovac Renewal (trademark) Rechargeable Alkaline Battery System consists of rechargeable alkaline zinc-manganese dioxide 1.5 volt batteries, in sizes AAA, AA, C, and D, and a recharging device for the batteries. Typical consumer applications of household bat- teries include toys and games, portable audio equipment, cameras, sporting goods equipment, test equipment, personal care prod- ucts, hearing aids, portable data terminals, sub-notebook computers and personal digital assistants, watches, flashlights, lanterns, and cellular phones. Such applications typically require continuous currents of up to 400 milliamperes (mA), which is within the range of the Renewal (trademark) batteries, sized AA, C, and D. Size AAA can supply up to 150 mA continuous current, which is sufficient for applications such as clocks.

NTIS

Alkaline Batteries; Recharging; Environment Protection

19990103352 Pennsylvania State Univ., Dept. of Electrical Engineering, University Park, PA USA

Peak Shaving and Alternative Power: A Question of Economy, Quality of Life and Quality of Electricity

Smith, David M.; Jul. 1999; 65p; In English

Report No.(s): AD-A367252; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The Navy will need to upgrade the utility infrastructure of its installations in the coming years. There are several factors that they will need to take into consideration, to include energy conservation, environmental and quality of life issues. Peak shaving and load shedding are good business decisions and could be conducted in a better way than they are currently being done. Fuel cells offer a variety of options for co-generation and power management. A prudent use of the by-products of electric generation from a fuel cell could increase efficiency of the plant and provide cost savings to the user. The objective of this paper is to look at the problem of being able to peak shave without penalizing the equipment and personnel on board ships that are in port. by understanding the technologies available in fuel cells, a proper choice and proposal can be made. As Molten Carbonate Fuel Cells and Solid Oxide Fuel Cells become commercially available, the Navy needs to consider using them as power sources for the piers. The co-generation capabilities would be used to generate clean shore steam, one of the many pier services that the ships require.

DTIC

Electricity; Energy Conservation; Environmental Quality; Environment Management

19990104607 Materials Research Society, Warrendale, PA USA

Thermoelectric Materials 1998 - The Next Generation Materials for Small-Scale Refrigeration and Power Generation Applications. Symposium Held November 30-December 3, 1998, Boston, Massachusetts. Volume 545

Tritt, Terry M.; Kanatzidis, Mercouri G.; Mahan, Gerald D.; Lyon, Hylan B., Jr; Dec. 1998; 526p; In English

Contract(s)/Grant(s): N00014-99-1-0169

Report No.(s): AD-A367262; No Copyright; Avail: CASI; A23, Hardcopy; A04, Microfiche

This proceedings volume from Symposium Z at the 1998 MRS Fall Meeting in Boston, Massachusetts, is the third in a series of MRS proceedings related to research in new thermoelectric materials (see MRS Proceedings Vol. 234 (1991) and Vol. 478 (1997). Thermoelectric materials are used in a wide variety of applications related to small-scale solid-state refrigeration or power generation. Over the past 30 years, alloys based on the Bi-Te compounds (refrigeration) $(Bi(1-x)Sbx)2$ $(Te(1-x)Sex)3$ and $Si(1-x)Gex$ compounds (power generation) have been extensively studied and optimized for their use as thermoelectric materials. Thermoelectric cooling is an environmentally friendly method of small-scale cooling in specific applications such as cooling computer chips and laser diodes. Currently, one of the most common uses of thermoelectric refrigeration materials is in small beverage coolers. Another very important application of thermoelectric materials is in power generation for deep-space probes such as in the Voyager and Cassini missions. Despite the extensive investigation of these traditional thermoelectric materials, there is still substantial room for improvement, and thus, entirely new classes of compounds will have to be investigated. Therefore, the focus of this symposium centers around the development of "The Next Generation Materials for Small-Scale Refrigeration and Power Generation Applications."
DTIC

Conferences; Refrigerating; Thermoelectric Cooling; Bismuth Tellurides

19990104673 MBC Applied Environmental Sciences, Inc., Costa Mesa, CA USA

Information Transfer Meeting (7th)

Jun. 1999; 116p; In English; 7th, 19-21 Jan. 1999, Anchorage, AK, USA

Report No.(s): PB99-169070; OCS/MMS-99-0022; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

The proceedings contain abstracts of the presentations during the Seventh Transfer Meeting. The meeting, which was organized by the Alaska OCS Region of the Minerals Management Service (MMS), focused on environmental information about lease sale areas in the Beaufort Sea and Cook Inlet. Over fifty speakers presented updates of on-going MMS-funded and related studies, covering a broad spectrum of topics in the fields of Physical Oceanography, Fates, and Effects of Contaminants, Protected Species, General Biology, and Socioeconomics. The Proceedings contain edited summaries of two panel discussion on Bowhead Whale Research by the North Slope Borough, and on the MMS Environmental Studies Program.
NTIS

Information Transfer; Conferences; Marine Biology; Energy Sources

19990105640 Houston Univ., TX USA

Conceptual Design of a Martian Power Generating System Utilizing Solar and Wind Energy

Second Annual HEDS-UP Forum; 1999, pp. 131-145; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

An all-solar manned mission to Mars must overdesign the photovoltaic array in order to handle dust storm conditions. Wind energy extraction is proven terrestrial technology which can offset the dust storm (and night-time) reductions. A multi-phase project is underway to assess the feasibility and drive the development of wind energy extraction systems for Mars. This project has specifically addressed the design of a Darrieus-style Vertical Axis Wind Turbine (VAWT). The project assumed that wind energy extraction would be a secondary production system to the photovoltaic array. Energy production of 300 kw-hr per Martian day is required for this application. The wind turbine is designed by iteratively stepping through the following tasks: 1 .Choose a blade shape; 2. Calculate the aerodynamic loads (primarily to estimate performance); 3. Design the guy cables; 4. Design the blades; 5. Design the tower; and 6. Choose support equipment. The resulting system was estimated at 944 kg. Based on the feasibility assessment mentioned above, a wind speed of 28 m/s or higher must be seen for at least an hour each day. This wind speed is in the realm of possibility as the expected slope winds on Mars will likely be this high or higher. In order to meet this feasibility, the following design trends were seen: low pre-tension guy wires; ultralight blades; and thin lightweight towers. This work also found that if 25 to 35 mls winds are available for at least one hour during a Martian day (during a dust storm), then wind energy extraction can be expected to be at least as mass-efficient as solar arrays (during a dust storm). Significant issues such as structural dynamics, thermal expansion/contraction, fatigue, blade struts, deployability, and maintainability were not considered at this time.
Author

Aerodynamic Loads; Dynamic Structural Analysis; Estimating; Feasibility Analysis; Manned Mars Missions; Electric Generators

19990106255 Sandia National Labs., Albuquerque, NM USA

Degradation Reactions in SONY-Type Li-Ion Batteries

Nagasubramanian, G.; Roth, E.; May 04, 1999; 6p; In English, 5-9 Apr. 1999, San Francisco, CA, USA; Sponsored by Materials Research Society, USA

Report No.(s): DE00-007233; SAND99-1116C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

   Thermal instabilities were identified in SONY-type lithium-ion cells and correlated with interactions of cell constituents and reaction products. Three temperature regions of interaction were identified and associated with the state of charge (degree of Li intercalation) of the cell.

NTIS

Electric Batteries; Degradation; Lithium; Metal Ions

19990106256 Sandia National Labs., Albuquerque, NM USA

Evaluation of Aerogel Materials for High-Temperature Batteries

Ashley, C. S.; Guidotti, R. A.; Reed, S. T.; Reinhardt, F. W.; May 04, 1999; 6p; In English; 34th; 34th Intersociety Energy Conversion Engineering Conference, 1-5 Aug. 1999, Vancouver, British Columbia, Canada

Report No.(s): DE00-007232; SAND99-1115C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

   Silica aerogels have 1/3 the thermal conductivity of the best commercial composite insulations. However, aerogels are transparent in the near IR region of 4-7 micro m, which is where the radiation peak from a thermal-battery stack occurs. Titania and carbon-black powders were examined as thermal opacifiers, to reduce radiation at temperatures between 300 deg. C and 600 deg. C, which spans the range of operating temperature for most thermal batteries. The effectiveness of the various opacifiers depended on the loading, with the best overall results being obtained using aerogels filled with carbon black. Fabrication and strength issues still remain, however.

NTIS

Thermal Batteries; Thermal Insulation; Evaluation; Aerogels; High Temperature; Operating Temperature; Opacifiers; Fabrication

45
ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

19990099371 MVA Ltd., London, UK

A Policy-Sensitive Forecasting System for Evaluating the Economic and Environmental Effects of Measures to Reduce Aircraft Emissions

Lowe, Steve, MVA Ltd., UK; Baarse, Gerrit, Resource Analysis, Netherlands; vanVelzen, Andre, Resource Analysis, Netherlands; tenHave, Helmut, National Aerospace Lab., Netherlands; Pulles, Hans, Rijksluchtvaartdienst, Netherlands; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 22p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

   Continuing growth in civil aviation activity may be having adverse impacts on global warming and UV radiation due to aircraft emissions in the upper atmosphere. Recognising this, but that mitigating measures might themselves have adverse economic implications for the aviation industry and national economies, the Dutch government commissioned Project AERO (Aviation Emissions and Evaluation of Reduction Options) to find the "best" strategy to reduce air traffic effects on the atmosphere, by weighing the environmental benefits against the economic consequences. Project AERO has created a forecasting system of future world-wide aviation activity. with its environmental and economic impacts, to test a wide range of fiscal and regulatory measures that might reduce aircraft emissions, and to establish trade-offs between environmental effectiveness and the economic consequences for airlines. users and governments. The system's forecasts are largely driven by demand growth, but costs imposed on airline operation by policy measures are modelled to feed back to fares, and hence restraint of demand growth. capacity provided and airline profitability. Aircraft technology development is explicitly represented, and emission volumes, their spatial distribution and atmospheric impacts are also modelled. The paper describes the AERO system and presents preliminary results of policy tests.

Author

Commercial Aircraft; Economic Impact; Environment Effects; Forecasting; Test Ranges; Evaluation; Exhaust Emission; Spacecraft Glow

19990099372 Tamkang Univ., Taipei, Taiwan, Province of China

Modeling Airline Competition With Two Fare Classes Under Static and Dynamic Games

Shyr, Feng–Yeu, Tamkang Univ., Taiwan, Province of China; Li, Chung–Pin, Tamkang Univ., Taiwan, Province of China; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 16p; In English; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Since the regulations on air fares, flight frequency, and the number of airlines for each O-D market have been removed in the last decade, Taiwan's domestic air travel market has now become one of the most competitive market in Southeast Asia. In order to assess the impact of deregulation, this paper applies game theory to seek for the strategic interaction among airlines in the oligopolistic competition environment. The strategies related to pricing include discount prices, service upgrade, and frequent flyer programs; for those related to quality of service include foods, comfort of seating, entertaining programs, reliability of schedule, baggage handling, and the frequency of direct and transfer flights. This paper focuses on the price and fi7equency competition of domestic airlines. Meanwhile, since the flight distances of all Taiwan's domestic routes are less than 500 miles, therefore, this paper emphasizes on direct flights only. The objectives of this paper are as follow: 1) develop a mathematical model that interpret and predict the interaction among airlines in the competition market; 2) provide a guideline for airlines in the decision of prices and frequency of flights; and 3) present an analytical tool for policy makers in the impact assessment of deregulation.
Author

Regulations; Policies; Mathematical Models; Game Theory; Competition; Commercial Aircraft; Civil Aviation; Airline Operations

19990099373 Tel-Aviv Univ., Ramat-Aviv, Dept. of Geography, Tel-Aviv, Israel

Air Transport Network Development

Goodovitch, Tomer, Tel-Aviv Univ., Ramat-Aviv, Israel; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 10p; In English; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The high standards of living and mobility of post-war society have led to an increasing use of air transport. In the case of road, rail and air transport, this has produced an important impact on the physical landscape. These systems are almost always developed in order to meet a specific demand. Transportation studies have concerned themselves with physical layout, the origin and destination of passenger and cargo movements, and the character of transport centres, in which the essential elements are access (i.e., to activity sites) and mobility (i.e., the ability to move between them). Little attention was paid, however, to the development process and planning of transport geography. This process has been repeated in many places, thus creating a particular geographic pattern, leading to a general model of transport development. The review of the literature of geographical studies of transportation usually begins with Ullman, who used topology to explain spatial interaction. However, the broad outline of transport development was first demonstrated by Taaffe, Morrill and Gould, who developed a descriptive generalisation of a typical sequence of transportation development, and later continued by Rimmer who adopted and improved the model in the search for spatial regularities by comparing the changes in the evolution of New Zealand and Australian seaports. The critics of transport geography, which was at the forefront of empirical quantitative geography, claim that it had become entrapped by its own narrow emphasis on network analysis and mechanistic models, and also too enamoured of the details of rational behaviour, such as minimisation of costs and distance. This theoretical approach has not changed, despite the criticism of it as mere descriptive modelling. Yet the critics failed to indicate which methodology ought to replace it. The quest for an explanation based upon generalizations and the search for universal empirical norms continued during the 1990s in the work of Bell and Cloke. My paper attempts to dispel the notion that ideal empirical research is irreplaceable. We are setting out what Bhaskar would describe as the ideal conditions under which air transport development should occur and suggesting what we can learn from the results of this process, rather than presupposing a preconceived idea about the nature of airline operations.
Derived from text

Air Traffic Control; Transportation; Optimization; Norms; Network Analysis; Layouts; Costs; Airline Operations

19990100648 NASA Langley Research Center, Hampton, VA USA

Impact of Aircraft Emissions on Reactive Nitrogen over the North Atlantic Flight Corridor Region

Koike, M., Nagoya Univ., Japan; Kondo, Y., Nagoya Univ., Japan; Ikeda, H., Nagoya Univ., Japan; Gregory, G. L., NASA Langley Research Center, USA; Anderson, B. E., NASA Langley Research Center, USA; Sachse, G. W., NASA Langley Research Center, USA; Blake, D., California Univ., USA; Liu, S. C., Georgia Inst. of Tech., USA; Singh, H. B., NASA Ames Research Center, USA; Thompson, A., NASA Goddard Space Flight Center, USA; Aug. 16, 1999; 38p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The impact of aircraft emissions on reactive nitrogen in the upper troposphere (UT) and lowermost stratosphere (LS) was estimated using the NO(y)-O3 correlation obtained during the SASS Ozone and NO(x) Experiment (SONEX) carried out over the US continent and North Atlantic Flight Corridor (NAFC) region in October and November 1997. to evaluate the large scale impact, we made a reference NO(y)-O3 relationship in air masses, upon which aircraft emissions were considered to have little impact. For this purpose, the integrated input of NO(x) from aircraft into an air mass along a 10-d back trajectory (DELTA-NO(y)) was calculated based on the ANCAT/EC2 emission inventory. The excess NO(y) (dNO(y)) was calculated from the observed NO(y) and the reference NO(y)-O3 relationship. As a result, a weak positive correlation was found between the dNO(y) and DELTA-NO(y), and dNO(y) and NO(x)/NO(y) values, while no positive correlation between the dNO(y) and CO values was found, suggesting that dNO(y) values can be used as a measure of the NO(x) input from aircraft emissions. The excess NO(y) values calculated from another NO(y)-O3 reference relationship made using in-situ CN data also agreed with these dNO(y) values, within the uncertainties. At the NAFC region (45 N - 60 N), the median value of dNO(y) in the troposphere increased with altitude above 9 km and reached 70 pptv (20% of NO(y)) at 11 km. The excess NO(x) was estimated to be about half of the dNO(y) values, corresponding to 30% of the observed NO(x) level. Higher dNO(y) values were generally found in air masses where O3 = 75 - 125 ppbv, suggesting a more pronounced effect around the tropopause. The median value of dNO(y) in the stratosphere at the NAFC region at 8.5 - 11.5 km was about 120 pptv. The higher dNO(y) values in the LS were probably due to the accumulated effect of aircraft emissions, given the long residence time of affected air in the LS. Similar dNO(y) values were also obtained in air masses sampled over the US continent.

Author

Air Masses; Atmospheric Circulation; Atmospheric Chemistry; Nitrogen Oxides; Radicals; Ozone

19990100657 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Influence of Airmass Histories on Radical Species during POLARIS

Pierson, J. M., Universities Space Research Association, USA; Kawa, S. R., NASA Goddard Space Flight Center, USA; Salawitch, R. J., Jet Propulsion Lab., California Inst. of Tech., USA; Hanisco, T. F., Harvard Univ., USA; Lanzendorf, E. J., Harvard Univ., USA; Perkins, K. K., Harvard Univ., USA; Gao, R. S., National Oceanic and Atmospheric Administration, USA; Cohen, R. C., California Univ., USA; [1999]; 35p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Goddard trajectory chemistry model was used with ER-2 aircraft data to test our current knowledge of radical photochemistry during the POLARIS (Polar Ozone Loss in the Arctic Region In Summer) campaign. The results of the trajectory chemistry model with and without trajectories are used to identify cases where steady state does not accurately describe the measurements. Over the entire mission, using trajectory chemistry reduces the variability in the modeled NO(x) comparisons to data by 25% with respect to the same model simulating steady state. Although the variability is reduced, NO(x)/NO(y) trajectory model results were found to be systematically low relative to the observations by 20-30% as seen in previous studies. Using new rate constants for reactions important in NO(y) partitioning improves the agreement of NO(x)/NO(y) with the observations but a 5-10% bias still exists. OH and HO2 individually are underpredicted by 15% of the standard steady state model and worsen with the new rate constants. Trajectory chemistry model results of OH/HO2 were systematically low by 10-20% but improve using the new rates constants because of the explicit dependence on NO. This suggests that our understanding of NO(x) is accurate to the 20% level and HO(x) chemistry is accurate to the 30% level in the lower stratosphere or better for the POLARIS regime. The behavior of the NO(x) and HO(x) comparisons to data using steady state versus trajectory chemistry and with updated rate coefficients is discussed in ten-ns of known chemical mechanisms and lifetimes.

Author

Ozone; Losses; Photochemical Reactions; Atmospheric Chemistry; Air Masses; Reaction Kinetics

19990100666 NASA Goddard Space Flight Center, Greenbelt, MD USA

Global Seasonal Climatologies of Ocean Chlorophyll: Blending In situ and Satellite Data for the CZCS Era

Gregg, Watson W., NASA Goddard Space Flight Center, USA; Conkright, Margarita E., National Oceanographic Data Center, USA; 1999; 27p; In English; Original contains color illustrations

Contract(s)/Grant(s): NOAA-RO-97-444/146-76-05; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The historical archives of in situ (National Oceanographic Data Center) and satellite (Coastal Zone Color Scanner) chlorophyll data were combined using the blended analysis method of Reynolds [1988] in an attempt to construct an improved climatological seasonal representation of global chlorophyll distributions. The results of the blended analysis differed dramatically from the CZCS representation: global chlorophyll estimates increased 8-35% in the blended analysis depending upon season. Regional differences were even larger, up to 140% in the equatorial Indian Ocean in summer (during the southwest monsoon). Tropical Pacific chlorophyll values increased 25-41%. The results suggested that the CZCS generally underestimates chlorophyll.

Regional and seasonal differences in the blended analysis were sufficiently large as to produce a different representation of global chlorophyll distributions than otherwise inferred from CZCS data alone. Analyses of primary production and biogeochemical cycles may be substantially impacted by these results.

Author

Chlorophylls; Phytoplankton; Climatology; Climate Change; Tropical Regions; Coastal Zone Color Scanner; Oceanographic Parameters; Ocean Data Acquisitions Systems

19990100668 Department of Energy, Energy Information Administration, Washington, DC USA

Emissions of greenhouse gases in the USA 1997

Oct. 31, 1998; 162p; In English

Report No.(s): DE99-000414; DOE/EIA-0573(97); No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

This is the sixth annual report on aggregate US national emissions of greenhouse gases. It covers emissions over the period 1990--1996, with preliminary estimates of emissions for 1997. Chapter one summarizes some background information about global climate change and the greenhouse effect. Important recent developments in global climate change activities are discussed, especially the third Conference of the Parties to the Framework Convention on Climate Change, which was held in December of 1997 in Kyoto, Japan. Chapters two through five cover emissions of carbon dioxide, methane, nitrous oxide, halocarbons and related gases, respectively. Chapter six describes potential sequestration and emissions of greenhouse gases as a result of land use changes.

NTIS

Emission; Greenhouse Effect; Climatology

19990100712 NASA Marshall Space Flight Center, Huntsville, AL USA

Statistical Approach for Determining the Onsets/Durations of ENSO Cycle Extremes

Wilson, Robert M., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

During the interval of 1950-mid 1998, some 16 El Nino and 10 La Nina have been identified on the basis of sea surface temperature in the Nino 3.4 region, these 26 events representing the extremes of the quasi-periodic ENSO cycle. Statistical aspects of these events are examined. Surprisingly, the durations of El Nino and La Nina appear to be strongly bifurcated into shorter and longer duration classes, as do the recurrence periods of El Nino. Moreover, the duration of an El Nino appears to provide a statistically meaningful indication as to when to expect the next onset of El Nino. Because the last El Nino had its onset in April 1997 and was of longer duration, onset of the next El Nino, probably, will not occur until after February 2000.

Author

Statistical Analysis; Cycles; Time; Southern Oscillation; El Nino

19990101420 National Renewable Energy Lab., Golden, CO USA

Particulate Measurements and Emissions Characterization of Alternative Fuel Vehicle Exhaust

Norbeck, J. M., National Renewable Energy Lab., USA; Nov. 19, 1998; 76p; In English

Report No.(s): DE00-006695; NREL/SR-540-25741; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The objective of this project was to measure and characterize particulate emissions from light-duty alternative fuel vehicles (AFVs) and equivalent gasoline-fueled vehicles. The project included emission testing of a fleet of 129 gasoline-fueled vehicles and 19 diesel vehicles. Particulate measurements were obtained over Federal Test Procedure and US06 cycles. Chemical characterization of the exhaust particulate was also performed. Overall, the particulate emissions from modern technology compressed natural gas and methanol vehicles were low, but were still comparable to those of similar technology gasoline vehicles.

NTIS

Particulates; Exhaust Emission; Methyl Alcohol; Automobile Fuels; Exhaust Gases

19990102050 Environmental Protection Agency, Washington, DC USA

Monitoring evaluation, reporting and verification of climate change mitigation projects

Vine, E.; Sathaye, J.; May 31, 1998; 24p; In English

Report No.(s): DE98-056102; LBNL-41520; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Because of concerns with the growing threat of global climate change from increasing emissions of greenhouse gases, the US and other countries are implementing, by themselves or in cooperation with one or more other nations, climate change mitigation projects. These projects will reduce greenhouse gas (GHG) emissions or sequester carbon, and will also result in non-GHG benefits (i.e., environmental, economic, and social benefits). Monitoring, evaluating, reporting, and verifying (MERV) guidelines

are needed for these projects to accurately determine their net GHG, and other, benefits. Implementation of MERV guidelines is also intended to: (1) increase the reliability of data for estimating GHG benefits; (2) provide real-time data so that mid-course corrections can be made; (3) introduce consistency and transparency across project types and reporters; and (4) enhance the credibility of the projects with stakeholders. In this paper, the authors review the issues involved in MERV activities. They identify several topics that future protocols and guidelines need to address, such as: (1) establishing a credible baseline; (2) accounting for impacts outside project boundaries through leakage; (3) net GHG reductions and other benefits; (4) precision of measurement; (5) MERV frequency; (6) persistence (sustainability) of savings, emissions reduction, and carbon sequestration; (7) reporting by multiple project participants; (8) verification of GHG reduction credits; (9) uncertainty and risk; (10) institutional capacity in conducting MERV; and (11) the cost of MERV.
NTIS
Climate Change; Pollution Monitoring; Air Pollution

19990102608 NASA Goddard Space Flight Center, Greenbelt, MD USA
Ozone Budgets from a Global Chemistry/ Transport Model and Comparison to Observations from POLARIS
Kawa, S. Randy, NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 13 Jan. 1999, Boulder, CO, USA; Sponsored by National Oceanic and Atmospheric Administration, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The objective of the Photochemistry of Ozone Loss in the Arctic Region in Summer (POLARIS) field mission was to obtain data to better characterize the summertime seasonal decrease of ozone at mid to high latitudes. The decrease in ozone occurs mainly in the lower stratosphere and is expected to result from in situ chemical destruction. Instrumented balloons and aircraft were used in POLARIS, along with satellites, to measure ozone and chemical species which are involved with stratospheric ozone chemistry. In order to close the seasonal ozone budget, however, ozone transport must also be estimated. Comparison to a global chemistry and transport model (CTM) of the stratosphere indicates how well the summertime ozone loss processes are simulated and thus how well we can predict the ozone response to changing amounts of chemical source gases. Moreover, the model gives insight into the possible relative magnitude of transport contributions to the seasonal ozone decline. Initial comparison to the Goddard CTM, which uses transport winds and temperatures from meteorological data assimilation, shows a high ozone bias in the model and an attenuated summertime ozone loss cycle. Comparison of the model chemical partitioning, and ozone catalytic loss rates to those derived from measurements shows fairly close agreement both at ER-2 altitudes (20 km) and higher. This suggests that the model transport is too active in resupplying ozone to the high latitude region, although chemistry failings cannot be completely ruled out. Comparison of ozone and related species will be shown along with a full diagnosis of the model ozone budget and its possible sources of error.
Author
Arctic Regions; Ozone; Stratosphere; Ozone Depletion; Atmospheric Models; Atmospheric Circulation; Ozonometry

19990102860 NASA Marshall Space Flight Center, Huntsville, AL USA
Project ATLANTA (Atlanta Land use Analysis: Temperature and Air Quality): Use of Remote Sensing and Modeling to Analyze How Urban Land Use Change Affects Meteorology and Air Quality Through Time
Quattrochi, Dale A., NASA Marshall Space Flight Center, USA; Luvall, Jeffrey C., NASA Marshall Space Flight Center, USA; Estes, Maurice G., Jr., NASA Marshall Space Flight Center, USA; 1999; In English, 23 Mar. 1999, Honolulu, HI, USA; Sponsored by AAG Inernational; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper presents an overview of Project ATLANTA (ATlanta Land use ANalysis: Temperature and Air-quality) which is an investigation that seeks to observe, measure, model, and analyze how the rapid growth of the Atlanta, Georgia metropolitan area since the early 1970's has impacted the region's climate and air quality. The primary objectives for this research effort are: (1) to investigate and model the relationships between land cover change in the Atlanta metropolitan, and the development of the urban heat island phenomenon through time; (2) to investigate and model the temporal relationships between Atlanta urban growth and land cover change on air quality; and (3) to model the overall effects of urban development on surface energy budget characteristics across the Atlanta urban landscape through time. Our key goal is to derive a better scientific understanding of how land cover changes associated with urbanization in the Atlanta area, principally in transforming forest lands to urban land covers through time, has, and will, effect local and regional climate, surface energy flux, and air quality characteristics. Allied with this goal is the prospect that the results from this research can be applied by urban planners, environmental managers and other decision-makers, for determining how urbanization has impacted the climate and overall environment of the Atlanta area. Multiscaled remote

sensing data, particularly high resolution thermal infrared data, are integral to this study for the analysis of thermal energy fluxes across the Atlanta urban landscape.
Author
Air Quality; Cities; Heat Islands; Land Use; Terrain; Urban Development

19990102863 NASA Marshall Space Flight Center, Huntsville, AL USA
Systematic Differences between Satellite-Based Presipitation Climatologies over the Tropical Oceans
Robertson, Frankin R., NASA Marshall Space Flight Center, USA; Fitzjarrald, Dan, NASA Marshall Space Flight Center, USA; McCaul, Eugene W., Universities Space Research Association, USA; 1999; In English; 79th, 10-15 Jan. 1999, Dallas, TX, USA; Sponsored by American Meteorological Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Since the beginning of the World Climate Research Program's Global Precipitation Climatology Project (GPCP) satellite remote sensing of precipitation has made dramatic improvements, particularly for tropical regions. Data from microwave and infrared sensors now form the most critical input to precipitation data sets and can be calibrated with surface gauges to so that the strengths of each data source can be maximized in some statistically optimal sense. It is clear however that there still remain significant uncertainties with satellite precipitation retrievals which limit their usefulness for many purposes. Systematic differences i'A tropical precipitation estimates have been brought to light in comparison activities such as the GPCP Algorithm Intercomparison Project and more recent Wetnet Precipitation Intercomparison Project 3. These uncertainties are assuming more importance because of the demands for validation associated with global climate modeling and data assimilation methodologies. The objective of the present study is to determine the physical basis for systematic differences in spatial structure of tropical precipitation as portrayed by several different satellite-based data sets. The study is limited to oceanic regions only and deals primarily with aspects of spatial variability. We are specifically interested in why MSU channel 1 and GPI precipitation differences are so striking over the Eastern Pacific ITCZ and why they both differ from other microwave emission-based precipitation estimates from SSM/I and a scattering-based deep convective ice index from MSU channel 2. Our results to date have shown that MSU channel I precipitation estimates are biased high over the Eastern Pacific ITCZ because of two factors: (1) the hypersensitivity of this frequency to cloud water in contrast to falling rain drops, and (2) unaccounted for scattering effects by precipitation-size ice which depresses the signal of the liquid water emission. Likewise, cold cloud top climatologies such as the GPI show an excess (a deficit) in estimated rainfall over the E. Pacific ITCZ (Warm Pool region). We show that these algorithms need to account for regionally varying heights (or temperatures) at which tropical convection detrains to form cirrus shields. A second objective we pursue is to identify variations in the macroscale cloud physical and thermodynamic properties of precipitation regimes" and relate these differences to tropical dynamical mechanisms of tropical heat and moisture balance. Finally, we interpret the algorithm differences and their associations with tropical dynamics in terms of WCRP GPCP goals for constructing precipitation climatologies.
Author
Precipitation (Meteorology); Climatology; Tropical Regions; Oceans; Satellite Observation; Calibrating; Estimates; Microwave Sensors

19990102882 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
Model for Predicting Anomalies of OLR in Tropic Region During ENSO *Model Prediksi Anomali OLR dan Curah Hujan di Atas Wilayah Tropik dari Anomali Suhu Permukaan Laut Pasifik Tropik Selama ENSO*
Kustiyo, Hamzah Arief, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Adiningsih, Erna Sri, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Harini, Sri, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Gunawan, Hidayat, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; January 1999; ISSN 0126-0480; Volume 1, No. 1, pp. 31-36; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Usually occurrence of ENSO (El Nino Southern Oscillation) impact the dryness in Indonesia, therefore prediction for the ENSO and it's impact to climate over Indonesia was expected could decrease the worst social economic effects. The first principal component of EOF (Empirical Orthogonal Function) model extract the El NINO phenomena. CCA (Cross Correlation Analysis) model correlate pacific tropic sea surface temperature anomaly and OLR (Outgoing Longwave Radiation) anomaly in tropic region from 0 to 5 months delay. The goals of this research were the model for prediction OLR anomaly in tropic region from pacific tropic sea surface temperature anomaly, and the model of relationship between OLR and rain fall over Indonesia. Prediction model was based on 23 years data from 1974 to 1996, that data were OLR tropic (30 deg N - 30 deg S, 60 deg E - 90 deg W) as predictant, and Pacific tropic sea surface temperature (30 deg N - 30 deg S, 150 deg E - 90 deg W) as predictor. Relationship model between OLR and rainfall over Indonesia was based on data from 23 rainfall observation stations for 22 years (1974 - 1995). The prediction model of OLR anomaly was good enough to predict the OLR anomaly for zero month up to five months later. The

relationship between OLR and rain fall over Indonesia showed that the significance levels for December to June were high, but for July to November the significance levels decreased.

Author

Anomalies; Long Wave Radiation; Southern Oscillation; El Nino

19990102896 Los Alamos National Lab., NM USA

Pollutant transfer through air and water pathways in an urban environment

Brown, M.; Burian, S.; McPherson, T.; Streit, G.; Costigan, K.; Dec. 31, 1998; 4p; In English; American Meteorological Society meeting

Report No.(s): DE99-002298; LA-UR-98-3527; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The authors are attempting to simulate the transport and fate of pollutants through air and water pathways in an urban environment. This cross-disciplinary study involves linking together models of mesoscale meteorology, air pollution chemistry and deposition, urban runoff and storm water transport, water quality, and wetland chemistry and biology. The authors are focusing on the transport and fate of nitrogen species because (1) they track through both air and water pathways, (2) the physics, chemistry, and biology of the complete cycle is not well understood, and (3) they have important health, local ecosystem, and global climate implications. The authors will apply their linked modeling system to the Los Angeles basin, following the fate of nitrates from their beginning as nitrate-precursors produced by auto emissions and industrial processes, tracking their dispersion and chemistry as they are transported by regional winds and eventually wet or dry deposit on the ground, tracing their path as they are entrained into surface water runoff during rain events and carried into the storm water system, and then evaluating their impact on receiving water bodies such as wetlands where biologically-mediated chemical reactions take place. In this paper, the authors wish to give an overview of the project and at the conference show preliminary results.

NTIS

Air Pollution; Pollution Transport; Water Pollution; Water Quality

19990102925 Denver Univ., Dept. of Engineering, Denver, CO USA

Collection and Analysis of Aircraft Emitted Particles *Final Report*

Wilson, James Charles, Denver Univ., USA; 1999; 50p; In English

Contract(s)/Grant(s): NAG1-1918

Report No.(s): Rept-5-34884; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The University of Denver Aerosol Group proposed to adapt an impactor system for the collection of particles emitted by aircraft. The collection substrates were electron microscope grids which were analyzed by Dr. Pat Sheridan using a transmission electron microscope. The impactor was flown in the SNIFF behind aircraft and engine emissions were sampled. This report details the results of that work.

Author

Aerosols; Combustion Products; Controllers; Flow Measurement; Impactors; Exhaust Emission; Exhaust Gases

19990102944 Virginia Univ., Charlottesville, VA USA

Lase Validation Experiment, Pt-1 *Final Report, Oct. 1995 - Mar. 1999*

Garstang, Michael, Virginia Univ., USA; July 1999; 10p; In English

Contract(s)/Grant(s): NAG1-1774; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report discusses the work done in validation the Lidar Atmospheric Sensing Experiment (LASE) data. This data was analyzed and compared to data from the RS-80 radiosonde. After an error was found and corrected in the programs used to analyze the LASE data, the results were closer to the results expected. The interpretation of the LASE measurements was based on the use of the Goddard Cumulus Ensemble model. This work is further described in the report.

CASI

Atmospheric Sounding; Data Reduction; Clouds (Meteorology); Atmospheric Moisture; Climate Models; Hydrology Models

19990102945 NASA Langley Research Center, Hampton, VA USA

Carbon Monoxide Distributions and Atmosphere Transports over Southern Africa, Pt-2

Garstang, Michael, Virginia Univ., USA; Swap, Robert J., Virginia Univ., USA; Piketh, Stuart, Witwatersrand Univ., South Africa; Mason, Simon, Witwatersrand Univ., South Africa; Connors, Vickie, NASA Langley Research Center, USA; July 1999; 24p; In English; Sponsored in part by the Ernest Oppenheimer Memorial Trust W. D. Wilson Visiting Fellowship

Contract(s)/Grant(s): NAG1-1774; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Sources and transports of CO as measured by the Measurement of Air Pollution from Space (MAPS) over a substantial sector of the southern hemisphere between South America and southern Africa are described by air parcel trajectories based upon European Center for Medium Range Weather Forecasts (ECMWF) model data fields. Observations, made by NASA Shuttle astronauts during the October 1994 mission, of vegetation fires suggest a direct relationship between in situ biomass burning, at least over South America and southern Africa, and coincident tropospheric measurements of CO. Results of this paper indicate that the transport of CO from the surface to the levels of maximum MAPS sensitivity (about 450 hPa) over these regions is not of a direct nature due largely to the well stratified atmospheric environment. The atmospheric transport of CO from biomass burning within this region is found to occur over intercontinental scales over numbers of days to more than a week. Three distinct synoptic circulation and transport classes are found to have occurred over southern Africa during the October 1994 MAPS experiment: (1) transport from South America and Africa to southern Africa associated with elevated MAPS measured CO (> 150 ppbv); (2) weakening anticyclonic transport from South America associated with moderate CO (is less than 150 ppbv and is greater than 105 ppbv); and (3) transport from the high southern latitudes associated with low CO (is less than 105 ppbv).
Author
Atmospheric Circulation; Carbon Monoxide; Meteorological Parameters; Southern Hemisphere; Troposphere; Pollution Transport; Combustion Products

19990102951 NASA Glenn Research Center, Cleveland, OH USA
Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines
Wey, Chown Chou, Compiler, NASA Glenn Research Center, USA; June 1999; 254p; In English, 29-30 Jul. 1997, Cleveland, OH, USA; See also 19990102952 through 19990102964
Contract(s)/Grant(s): RTOP 538-08-12
Report No.(s): NASA/CP-1999-208918; E-11676; NAS 1.55:208918; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

In response to the National Research Council (NRC) recommendations, the Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines was organized by the NASA Lewis Research Center and held on July 29-30, 1997 at the Ohio Aerospace Institute in Cleveland, Ohio. The objective is to develop consensus among experts in the field of aerosols from gas turbine combustors and engines as to important issues and venues to be considered. Workshop participants' expertise included engine and aircraft design, combustion processes and kinetics, atmospheric science, fuels, and flight operations and instrumentation.
Author
Aerosols; Gas Turbine Engines; Particulates; Conferences; Exhaust Gases; Combustion Products

19990102952 NASA Glenn Research Center, Cleveland, OH USA
Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines
Niedzwiecki, Richard, NASA Glenn Research Center, USA; Dryer, Frederick L., Princeton Univ., USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 5-19; In English; See also 19990102951; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper reviews the relationships of the programs and projects and reviews the purpose of the Engine Exhaust Trace Chemistry (EETC) Committee. The charges of the Committee are: (1) to prioritize the engine trace constituents for assessing impacts of aircraft; (2) Assess both extractive and insitu measurement techniques; and (3) Determine the best venues for performing the necessary measurements. A synopsis of evidence supporting and questions concerning the role(s) of aerosol/particulates was presented. The presentation also reviewed how sulfur oxidation kinetics interactions in the hot-section and nozzle play a role in the formation of aerosol precursors. The objective of the workshop, and its organization is reviewed.
Derived from text
Aircraft Engines; Gas Turbine Engines; Air Pollution; Particulates; Trace Elements; Aerosols

19990102953 NASA Glenn Research Center, Cleveland, OH USA
Problem to Address: Local Air Quality
Niedzwiecki, Richard W., NASA Glenn Research Center, USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 21-44; In English; See also 19990102951; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation discusses the problem of local air quality as it is affected by modern aircraft engine exhaust and the objective of this workshop. It begins with a discussion on the nature and sources of particulates and aerosols. The problems, and the technical considerations of how to regulate the aircraft emissions, are reviewed. There is no local (i.e., state or county) regulations of the

aircraft operations. Amongst the conclusions are: (1) there is an inadequate database of information regarding the emittants from aircrafts. (2) That data which does exist represents older engines and aircraft, it is not representative of the advanced and future fleet.

CASI

Air Quality; Aircraft Engines; Flight Operations; Regulations; Pollution Control; Pollution Monitoring; Air Pollution

19990102954 Aerodyne Research, Inc., Billerica, MA USA

Statement of Problem: Engine and Near-Field; Aerosol and Particulate

Miake–Lye, R. C., Aerodyne Research, Inc., USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 45-54; In English; See also 19990102951; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

The primary objective of NASA's Atmospheric Effects of Aviation Project (AEAP) is to assess the global impact of emissions deposited in the atmosphere from commercial aviation operating at cruise altitudes. Historically, the global implications of aircraft emissions have not been the subject of legislative regulation as have near-airport impacts, so the measurements to quantify these high altitude emissions are not a standard part of engine certification and are generally are not available. Thus, a significant component of AEAP is to characterize the cruise emissions from the commercial fleet. In the first years of AEAP, planning and prioritizing of the species and measurement techniques were carried out to establish the direction of the emissions characterization element of AEAP. The current status of the activity to date is that CO_2, H_2O, and $NO(x)$, have been well characterized. These primary combustion products and the pollutant emissions that have been the focus of many global studies to data have been measured with multiple techniques and at multiple venues, including in-flight. In addition to these gaseous emissions, non-volatile (soot) particle number densities and particle size data are now available for many engines and multiple measurement venues, as well. From these efforts, primary emissions can be quantified with reasonable accuracy for the existing commercial fleet and projections for these emissions can be made for future technologies. On the other hand, modeling and in-flight measurements have raised questions about other emissions which have yet to be fully characterized. For $NO(x)$ emissions, the conversion to non-$NO(x)$ $NO(y)$ (HONO, HNO_3) has not been quantified. Based on chemical kinetics calculations, this conversion is expected to be modest and global modeling results suggest that, for such modest conversions, the global effects are predicted to be small. A more uncertain situation holds for sulfur emissions. The degree of SO_2 oxidation to SO_3 and H_2SO_4 also has not been quantified for many situations and has implications for aerosol formation as discussed. Further, the state of emitted aerosols needs characterization beyond the number densities and size distributions to understand how emitted aerosol may affect contrail and cloud formation. More specifically, when, where, and how does soot become condensation nuclei (CN) capable of condensing water vapor? In order to fully understand how these questions affect the global atmosphere, chemical and physical processes that are occurring in the near-field of the airplane's wake and, indeed, with in the engine itself need to be understood.

Author

Airline Operations; Atmospheric Effects; Combustion Products; Commercial Aircraft; Contaminants; Exhaust Emission; Air Pollution; Aircraft Engines

19990102955 NASA Goddard Space Flight Center, Greenbelt, MD USA

Potential Climate Impacts of Engine Particle Emissions

Kawa, S. Randy, NASA Goddard Space Flight Center, USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 55-60; In English; See also 19990102951; No Copyright; Avail: CASI; A02, Hardcopy; A03, Microfiche

Solid (soot) and liquid (presumed sulfate) particle emissions from aircraft engines may have serious impacts on the atmosphere. While the direct radiative impact of these particles is expected to be small relative to those from natural sources (Atmospheric Effects of Subsonic Aircraft: Interim Assessment of the Advanced Subsonic Technology Program, NASA Ref. Pub. 1400, 1997), their indirect effects on atmospheric chemistry and cloud formation may have a significant impact. The potential impacts of primary concern are the increase of sulfate surface area and accelerated heterogeneous chemical reactions, and the potential for either modified soot or sulfate particles to serve as cloud nuclei which would change the frequency or radiative characteristics of clouds. Volatile (sulfate) particle concentrations measured behind the Concorde aircraft in flight in the stratosphere were much higher than expected from near-field model calculations of particle formation and growth. Global model calculations constrained by these data calculate a greater level of stratospheric ozone depletion from the proposed High speed Civil Transport (HSCT) fleet than those without particle emission. Soot particles have also been proposed as important in heterogeneous chemistry but this remains to be substantiated. Aircraft volatile particle production in the troposphere has been shown by measurements to depend strongly on fuel sulfur content. Sulfate particles of sufficient size are known to provide a good nucleating surface for cloud growth. Although pure carbon soot is hydrophobic, the solid particle surface may incorporate more suitable nucleating sites. The non-volatile (soot) particles also tend to occupy the large end of aircraft particle size spectra. Quantitative connection between aircraft par-

ticle emissions and cloud modification has not been established yet, however, even small changes in cloud amount or properties could have a significant effect on the radiative balance of the atmosphere.
Author
Atmospheric Chemistry; Exhaust Emission; Exhaust Gases; Particle Emission; Soot; Supersonic Transports; Troposphere; Climate; Long Term Effects; Climate Change

19990102956 Missouri Univ., Rolla, MO USA
UMR Mobile Aerosol Sampling Facility and Smoke Meter
Hagen, D. E., Missouri Univ., USA; Whitefield, P. D., Missouri Univ., USA; Paladino, J., Missouri Univ., USA; Lilenfeld, H. V., Missouri Univ., USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 61-82; In English; See also 19990102951; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This presentation discusses the mobile aerosol sampling facility and the smoke meter developed at the University of Missouri-Rolla. The aerosol sampling facility device is designed to measure particulates within certain conditions. The properties of the particulates and the test conditions were discussed. Recent airborne sampling and ground test sampling campaigns are reviewed. A diagram of the mobile aerosol sampling system and several charts showing the aerosol size distribution are shown. The presentation then reviews the smoke meter, which attempts to measure the particulate emission in the jet engine exhaust flow. Several known volumes of exhaust are passed through a filter, and any change in the observed optical reflectance of the filter can be correlated to the quantity of particulate matter. The recent studies which used the smoke meter are reviewed.
CASI
Air Sampling; Jet Engines; Samplers; Sampling; Smoke; Aircraft Engines; Aerosols; Exhaust Emission; Particle Emission

19990102957 NASA Langley Research Center, Hampton, VA USA
Airborne Observations of Aerosol Emissions from F-16 Aircraft
Anderson, B. E., NASA Langley Research Center, USA; Cofer, W. R., NASA Langley Research Center, USA; McDougal, D. S., NASA Langley Research Center, USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 83-100; In English; See also 19990102951; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

We presented results from the SASS Near-Field Interactions Flight (SNIF-III) Experiment which was conducted during May and June 1997 in collaboration with the Vermont and New Jersey Air National Guard Units. The project objectives were to quantify the fraction of fuel sulfur converted to S(VI) species by jet engines and to gain a better understanding of particle formation and growth processes within aircraft wakes. Size and volatility segregated aerosol measurements along with sulfur species measurements were recorded in the exhaust of F-16 aircraft equipped with F-100 engines burning fuels with a range of fuel S concentrations at different altitudes and engine power settings. A total of 10 missions were flown in which F-16 exhaust plumes were sampled by an instrumented T-39 Sabreliner aircraft. On six of the flights, measurements were obtained behind the same two aircraft, one burning standard JP-8 fuel and the other either approximately 28 ppm or 1100 ppm S fuel or an equal mixture of the two (approximately 560 ppm S). A pair of flights was conducted for each fuel mixture, one at 30,000 ft altitude and the other starting at 35,000 ft and climbing to higher altitudes if contrail conditions were not encountered at the initial flight level. In each flight, the F-16s were operated at two power settings, approx. 80% and full military power. Exhaust emissions were sampled behind both aircraft at each flight level, power setting, and fuel S concentration at an initial aircraft separation of 30 m, gradually widening to about 3 km. Analyses of the aerosol data in the cases where fuel S was varied suggest results were consistent with observations from project SUCCESS, i.e., a significant fraction of the fuel S was oxidized to form S(VI) species and volatile particle emission indices (EIs) in comparably aged plumes exhibited a nonlinear dependence upon the fuel S concentration. For the high sulfur fuel, volatile particle EIs in 10-second-old-plumes were 2 to 3 x 10 (exp 17) / kg of fuel burned and exhibited no obvious trend with engine power setting or flight altitude. In contrast, about 8-fold fewer particles were observed in similarly aged plumes from the same aircraft burning fuel with 560 ppm S content and EIs of 1 x 10(exp 15)/ kg of fuel burned were observed in the 28 ppm S fuel case. Moreover, data recorded as a function of plume age indicates that formation and growth of the volatile particles proceeds more slowly as the fuel S level is reduced. For example, ultrafine particle concentrations appear to stabilize within 5 seconds after emission in the 1100 ppm S cases but are still increasing in 20-second old plumes produced from burning the 560 ppm S fuel.
Author
Aerosols; Aircraft Wakes; Exhaust Emission; Exhaust Gases; Particle Emission; Plumes; Jet Engine Fuels; Sulfur

19990102958 McDonnell-Douglas Corp., Saint Louis, MO USA
Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines
Lilenfeld, Harvey V., McDonnell-Douglas Corp., USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 101-121; In English; See also 19990102951; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Prior to 1990, the major source of measurements on particulate emissions from aircraft utilized the measurement of 'smoke numbers'. This technique was developed to quantify the light scattering properties of engine exhaust, but is not directly applicable for modeling of the effects of engine particulates on the atmosphere. The data base for particulate emissions from aircraft flying in the atmosphere has increased dramatically in the last few years due to the implementation of equipment capable of measuring particle number densities, size distributions, hydration properties and emission indices. This equipment was developed to quantify engine exhaust emissions because of concerns of the environmental impact of supersonic and subsonic aircraft. This paper reports on the status of the data base obtained from these measurements and reports on the correlations currently being used to characterize the current and future fleets of aircraft flying in the troposphere and stratosphere. As a result of project Pollinet, a European campaign to measure the effects of emissions of subsonic aircraft, a number of particle emission indices were measured by workers from the University of,Missouri Rolla and their associates. These results for particle emission indices (particles/kg fuel burned) for both total particles and non-volatile particles (particles remaining after volatile particles are removed by heating to 170C) are correlated for a number of aircraft/engine combinations flight at 300 hft. The agreement among engine types for non-volatile particles (assumed to be predominantly soot) is generally good (within 20%) with a range among the aircraft intercepted of 2 x 10(exp 14) - 2 x 10(exp 11) particles/Kg fuel. These data were also correlated with smoke numbers obtained from the ICAO data base. Work-in-progress data base correlations are described for an assortment size distributions obtained from measurements on the ground, in the air and in altitude chambers taken during the NASA sponsored projects SNIF and SUCCESS. Interesting measurements of a NASA owned 737 aircraft with JT8 engines and a 757 aircraft with RB-211-535C engines are described. The 757 aircraft is of interest because of the difference seen for particles emissions between the port and starboard engines. This case is interesting because it is very atypical for results to vary this much between engines of the same type. Measurement of emission indices on the ground and in the air for the 757 aircraft are compared. In addition, measurements of this aircraft by several groups are compared. Measurements taken on the ground and in flight for military aircraft flying with F100 engines are compared. The older version of the F100 engine (F100-100 series) appears to have a greater emission than the later F100-200 model at high thrust settings. The emission from both of these older engines is more than an order of magnitude greater than the emissions from a modern engine. These results indicate the improvements made by industry of the past several decades on particulate emissions. The size distributions of particles emitted from these aircraft appear to change somewhat as a function fo thrust setting. Size distributions among the engine models F100-100 vs F100-200 are compared but the differences noted may represent different operating conditions as well as differences among engine models.
Author
Aerosols; Aircraft Engines; Exhaust Emission; Exhaust Gases; Gas Turbine Engines; Particle Emission; Jet Engines; Jet Exhaust

19990102959 NASA Glenn Research Center, Cleveland, OH USA
Engine Test and Measurements
Wey, Chown Chou, NASA Glenn Research Center, USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 123-134; In English; See also 19990102951; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Although the importance of aerosols and their precursors are now well recognized, the characterization of current subsonic engines for these emissions is far from complete. Furthermore, since the relationship of engine operating parameters to aerosol emissions is not known, extrapolation to untested and unbuilt engines necessarily remains highly uncertain. 1997 NASA LaRC engine test, as well as the parallel 1997 NASA LaRC flight measurement, attempts to address both issues by expanding measurements of aerosols and aerosol precursors with fuels containing different levels of fuel sulfur content. The specific objective of the 1997 engine test is to obtain a database of sulfur oxides emissions as well as the non-volatile particulate emission properties as a function of fuel sulfur and engine operating conditions. Four diagnostic systems, extractive and non-intrusive (optical), will be assembled for the gaseous and particulate emissions characterization measurements study. NASA is responsible for the extractive gaseous emissions measurement system which contains an array of analyzers dedicated to examining the concentrations of specific gases (NO, NO(x), CO, CO2, O2, THC, SO2) and the smoke number. University of Missouri-Rolla uses the Mobile Aerosol Sampling System to measure aerosol/particulate total concentration, size distribution, volatility and hydration property. Air Force Research Laboratory uses the Chemical Ionization Mass Spectrometer to measure SO2, SO3/H2SO4, and HN03 Aerodyne Research, Inc. uses Infrared Tunable Diode Laser system to measure SO2, SO3, NO, H2O, and CO2.
Author
Engine Tests; Gas Composition; Particulates; Jet Engines; Jet Exhaust

19990102960 Massachusetts Inst. of Tech., Aero-Environmental Research Lab., Cambridge, MA USA
Hot Section Modeling
Waitz, Ian A., Massachusetts Inst. of Tech., USA; Lukachko, S. P., Massachusetts Inst. of Tech., USA; Miake–Lye, Richard C., Aerodyne Research, Inc., USA; Brown, Robert C., Aerodyne Research, Inc., USA; Workshop on Aerosols and Particulates from

Aircraft Gas Turbine Engines; June 1999, pp. 135-162; In English; See also 19990102951; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

Many aircraft engine exhaust species that may perturb the atmosphere exist in trace amounts. These species can be transformed by chemical reaction within the engine prior to emission into the atmosphere. to better understand the role of intra-engine processes in determining the final composition of engine exhaust, a flow-chemistry model was developed over the last three years through a collaboration between the Massachusetts Institute of Technology (MIT) and Aerodyne Research, Inc. (ARI). This computational approach was used to investigate chemical processes that occur through the turbine and exhaust nozzle by simulating the post-combustor flow path over a range of physical representations, from simplified, homogenous cases to situations that incorporate complex fluid mechanics more typical of a modern aircraft turbine. Using a chemistry model that includes HO(x), NO(y) SO(x), and CO(x), reactions developed through the work of Robert C. Brown of ARI and Fred L. Dryer of Princeton University, several 1-D parametric analyses were conducted for the entire turbine and exhaust nozzle flowpath of a typical advanced subsonic engine to understand the effects of important flow and chemistry variations on species evolution in general, and the development of volatile aerosol precursors in particular. These studies highlighted the sensitivity of exhaust composition to the trace species concentrations specified at the combustor exit, mass addition within the turbine, and combustor exit temperature. Representative 2-D, single turbine blade row simulations were also performed to determine the potential impact of flow nonuniformities that cannot be captured directly or modeled simply through 1-D analyses. Temperature nonuniformities that result from the use of an internal blade cooling strategy were investigated and revealed a significant impact in SO(x) chemistry. Comparisons of 1-D approximations to the 2-D turbine solutions were then carried out to help determine the extent to which current 1-D modeling capabilities can resolve changes in chemical composition. The results call into question the validity of 1-D averaged flow analysis for the highly-nonuniform, unsteady flow fields of the turbine and exhaust nozzle. Suggestions for future work under the AEAP program are included.
Author
Aircraft Engines; Gas Turbine Engines; Simulation; Models; Turbine Exhaust Nozzles

19990102961 NASA Glenn Research Center, Cleveland, OH USA
Charge to Working Groups
Gorland, Sol, NASA Glenn Research Center, USA; Rabinowitz, Martin, NASA Glenn Research Center, USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 163-176; In English; See also 19990102951; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

The assignments and charges to the three workgroups are discussed. The three workgroups were: (1) Trace Chemistry, (2) Instrumentation, (3) Venues and procedures.
CASI
Personnel; Personnel Selection

19990102962 NASA Glenn Research Center, Cleveland, OH USA
Trace Chemistry
Radhakrishnan, Krishnan, NASA Glenn Research Center, USA; Whitefield, Philip, Missouri Univ., USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 177-178; In English; See also 19990102951; No Copyright; Avail: CASI; A01, Hardcopy; A03, Microfiche

The goals of the trace chemistry group were to identify the processes relevant to aerosol and aerosol precursor formation occurring within aircraft gas turbine engines; that is, within the combustor, turbine, and nozzle. The topics of discussion focused on whether the chemistry of aerosol formation is homogeneous or heterogeneous; what species are important for aerosol and aerosol precursor formation; what modeling/theoretical activities to pursue; what experiments to carry out that both support modeling activities and elucidate fundamental processes; and the role of particulates in aerosol and aerosol precursor formation. The consensus of the group was that attention should be focused on SO_2, SO_3, and aerosols. of immediate concern is the measurement of the concentration of the species SO_3, SO_2, H_2SO_4 OH, HO_2, H_2O_2, O, NO, NO_2, HONO, HNO_3, CO, and CO_2 and particulates in various engines, both those currently in use and those in development. The recommendation was that concentration measurements should be made at both the combustor exit and the engine exit. At each location the above species were classified into one of four categories of decreasing importance, Priority I through IV, as follows: Combustor exit: Priority I species - SO_3:SO_2 ratio, SO_3, SO_2, and particulates; Priority II species: OH and O; Priority III species - NO and NO_2; and Priority IV species - CO and CO_2. For the Engine exit: Priority I species - SO_3:SO_2 ratio, SO_3, SO_2,H_2SO_4, and particulates; Priority II species: OH,HO_2, H_2O_2, and O; Priority III species - NO, NO_2, HONO, and HNO_3; and Priority IV species - CO and CO_2. Table I summarizes the anticipated concentration range of each of these species. For particulate matter, the quantities of interest are the number density, size distribution, and composition. In order to provide data for validating multidimensional reacting flow models, it would be

desirable to make 2-D, time-resolved measurements of the concentrations of the above species and, in addition, of the pressure, temperature, and velocity. A near term goal of the experimental program should be to confirm the nonlinear effects of sulfur speciation, and if present, to provide an explanation for them. It is also desirable to examine if the particulate matter retains any sulfur. The recommendation is to examine the effects on SOx production of variations in fuel-bound sulfur and aromatic content (which may affect the amount of particulates formed). These experiments should help us to understand if there is a coupling between particulate formation and SO, concentration. Similarly, any coupling with NOx can be examined either by introducing NOx into the combustion air or by using fuel-bound nitrogen. Also of immediate urgency is the need to establish and validate a detailed mechanism for sulfur oxidation/aerosol formation, whose chemistry is concluded to be homogeneous, because there is not enough surface area for heterogeneous effects. It is envisaged that this work will involve both experimental and theoretical programs. The experimental work will require, in addition to the measurements described above, fundamental studies in devices such as flow reactors and shock tubes. Complementing this effort should be modeling and theoretical activities. One impediment to the successful modeling of sulfur oxidation is the lack of reliable data for thermodynamic and transport properties for several species, such as aqueous nitric acid, sulfur oxides, and sulfuric acid. Quantum mechanical calculations are recommended as a convenient means of deriving values for these properties. Such calculations would also help establish rate constants for several important reactions for which experimental measurements are inherently fraught with uncertainty. Efforts to implement sufficiently detailed chemistry into computational fluid dynamic codes should be continued. Zero- and one-dimensional flow models are also useful vehicles for elucidating the minimal set of species and reactions that must be included in two- and three-dimensional modeling studies.
Author
Aerosols; Aircraft Engines; Combustion Chambers; Concentration (Composition); Gas Turbine Engines; Mathematical Models; Oxidation; Particulates; Reaction Kinetics; Trace Contaminants

19990102964 NASA Glenn Research Center, Cleveland, OH USA
Aerosols and Particulates Workshop Sampling Procedures and Venues Working Group Summary
Pachlhofer, Peter, NASA Glenn Research Center, USA; Howard, Robert, Sverdrup Technology, Inc., USA; Workshop on Aerosols and Particulates from Aircraft Gas Turbine Engines; June 1999, pp. 187-237; In English; See also 19990102951; No Copyright; Avail: CASI; A04, Hardcopy; A03, Microfiche

The Sampling Procedures and Venues Workgroup discussed the potential venues available and issues associated with obtaining measurements. Some of the issues included Incoming Air Quality, Sampling Locations, Probes and Sample Systems. The following is a summary of the discussion of the issues and venues. The influence of inlet air to the measurement of exhaust species, especially trace chemical species, must be considered. Analysis procedures for current engine exhaust emissions regulatory measurements require adjustments for air inlet humidity. As a matter of course in scientific investigations, it is recommended that "background" measurements for any species, particulate or chemical, be performed during inlet air flow before initiation of combustion, if possible, and during the engine test period as feasible and practical. For current regulatory measurements, this would be equivalent to setting the "zero" level for conventional gas analyzers. As a minimum, it is recommended that measurements of the humidity and particulates in the incoming air be taken at the start and end of each test run. Additional measurement points taken during the run are desirable if they can be practically obtained. It was felt that the presence of trace gases in the incoming air is not a significant problem. However, investigators should consider the ambient levels and influences of local air pollution for species of interest. Desired measurement locations depend upon the investigation requirements. A complete investigation of phenomenology of particulate formation and growth requires measurements at a number of locations both within the engine and in the exhaust field downstream of the nozzle exit plane. Desirable locations for both extractive and in situ measurements include: (1) Combustion Zone (Multiple axial locations); (2) Combustor Exit (Multiple radial locations for annular combustors); (3) Turbine Stage (Inlet and exit of the stage); (4) Exit Nozzle (Multiple axial locations downstream of the nozzle). Actual locations with potential for extractive or non-intrusive measurements depend upon the test article and test configuration. Committee members expressed the importance of making investigators aware of various ports that could allow access to various stages of the existing engines. Port locations are engine si)ecific and might allow extractive sampling or innovative hybrid optical-probe access. The turbine stage region was one the most desirable locations for obtaining samples and might be accessed through boroscope ports available in some engine designs. Discussions of probes and sampling systems quickly identified issues dependent on particular measurement quantities. With general consensus, the group recommends SAE procedures for measurements and data analyses of currently regulated exhaust species (CO2, CO, THC, NO(x),) using conventional gas sampling techniques. Special procedures following sound scientific practices must be developed as required for species and/or measurement conditions not covered by SAE standards. Several issues arose concerning short lived radicals and highly reactive species. For conventional sampling, there are concerns of perturbing the sample during extraction, line losses, line-wall reactions, and chemical reactions during the sample transport to the analyzers. Sample lines coated with quartz.or other materials should be investigated for minimization of such effects. The group advocates the development of innovative probe techniques and non-intrusive optical techniques for measure-

ment of short lived radicals and highly reactive species that cannot be sampled accurately otherwise. Two innovative probe concepts were discussed. One concept uses specially designed probes to transfer optical beams to and from a region of flow inaccessible by traditional ports or windows. The probe can perturb the flow field but must have a negligible impact on the region to be optically sampled. Such probes are referred to as hybrid probes and are under development at AEDC for measurement in the high pressure, high temperature of a combustor under development for power generation. The other concept consists of coupling an instrument directly to the probe. The probe would isolate a representative sample stream, freeze chemical reactions and direct the sample into the analyzer portion of the probe. Thus, the measurement would be performed in situ without sample line losses due either to reactions or binding at the wall surfaces. This concept was used to develop a fast, in situ, time-of-flight mass spectrometer measurement system for temporal quantification of NO in the IMPULSE facility at AEDC. Additional work is required in this area to determine the best probe and sampling technique for each species measurement requirement identified by the Trace Chemistry Working Group. A partial list of Venues was used as a baseline for discussion. Additional venues were added to the list and the list was broken out into the following categories: (1)Engines (a) Sea Level Test Stands (b) Altitude Chambers; (2) Annular Combustor Test Stands, (3) Sector Flametube Test Stands, (4) Fundamentals Rigs/Experiments.
Author
Exhaust Emission; Particulates; Position (Location); Procedures; Sampling; Test Stands; Trace Elements; Jet Engines; Aerosols

19990103011 NASA Goddard Space Flight Center, Greenbelt, MD USA
Upper Limits of Predictability in Long-Range Climate/Hydrologic Forecasts
Koster, R. D., NASA Goddard Space Flight Center, USA; Suarez, M. J., NASA Goddard Space Flight Center, USA; Heiser, M., General Sciences Corp., USA; [1998]; 1p; In English, 6-10 Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The accurate forecasting of el nino or la nina conditions in the tropical Pacific can potentially lead to valuable predictions of hydrological anomalies over land at seasonal to interannual timescales. Even with highly accurate earth system models, though, our ability to generate these continental forecasts will always be limited by the chaotic nature of the atmospheric circulation. The nature of this fundamental limitation is explored through the use of 16-member ensembles of multi-decade GCM simulations. In each simulation of the first ensemble, sea surface temperatures (SSTs) are given the same realistic interannual variations over a 45-year period, and land surface state is allowed to evolve with that of the atmosphere. Analysis of the results shows that the SSTs control the temporal organization of continental precipitation anomalies to a significant extent in the tropics and to a much smaller extent in midlatitudes. In each simulation of the second ensemble, we prescribe SSTs as before, but we also prescribe interannual variations in the low frequency component of evaporation efficiency over land. Thus, in the second ensemble, we effectively make the extreme assumption that surface boundary conditions across the globe are perfectly predictable, and we quantify the consistency with which the atmosphere (particularly precipitation) responds to these boundary conditions. The resulting "absolute upper limit" on the predictability of precipitation is found to be quite high in the tropics yet only moderate in many midlatitude regions.
Author
El Nino; Air Water Interactions; Sea Surface Temperature; Pacific Ocean; Tropical Regions; Temperate Regions; Southern Oscillation; Anomalies

19990103050 Eastern Research Group, Inc., Lexington, MA USA
Urban Air Toxics Monitoring Program (UATMP), 1997
Jan. 1999; 594p; In English
Report No.(s): PB99-172728; EPA/600/R-99/036; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

This report presents the results of ambient air monitoring conducted as part of the 1997 Urban Air Toxics Monitoring Program (UATMP)--a program designed to characterize the magnitude and composition of potentially toxic air pollution in, or near, urban locations. The 1997 UATMP included 12 monitoring stations that collected 24-hour air samples, typically on a biweekly basis. These samples were analyzed for concentrations of 47 volatile organic compounds (VOC) and 16 carbonyls. Overall, nearly 28,000 ambient air concentrations were measured during the 1997 UATMP. This summary report uses various graphical, numerical, and statistical analyses to put this vast amount of ambient air monitoring data into perspective. This report is divided into sections that review the specific air quality trends for individual monitoring stations. Each section of this report presents a succinct, yet thorough, overview of the monitoring data collected at a particular site. Each section analyzes and interprets air quality trends for nine compounds (all nitriles and oxygenated compounds) that were not measured during previous UATMPs, including methyl tert-butyl ether--a compound that has received much attention lately due to its use as a fuel additive in may parts of the country.

Finally, to assess annual variations in air quality, each section describes how levels of air pollution have changed since the 1994 UATMP. Each section concludes by highlighting the most notable trends for the particular monitoring station.
NTIS
Air Quality; Toxicity; Air Pollution; Environmental Monitoring

19990103070 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Guideline for Reporting of Daily Air Quality: Air Quality Index (AQI)
Fitz–Simons, T.; Jul. 1999; 34p
Report No.(s): PB99-169237; EPA/454/R-99/010; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
This guidance is designed to aid local agencies in reporting the air quality using the AQI as required in Part 58.50 of 40 CFR and according to Part 58 of 40 CFR, Appendix G.
NTIS
Air Quality; Air Pollution; Pollution Monitoring; Pollution Control; Environment Pollution; Environment Effects

19990103110 NASA Goddard Space Flight Center, Greenbelt, MD USA
Nonlinear Insolation Forcing: A Physical Mechanism for Climate Change
Liu, H. S., NASA Goddard Space Flight Center, USA; [1998]; 1p; In English, 6-10 Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
This paper focuses on recent advances in the understanding of nonlinear insolation forcing for climate change. The amplitude-frequency resonances in the insolation variations induced by the Earth's changing obliquity are emergent and may provide a physical mechanism to drive the glaciation cycles. to establish the criterion that nonlinear insolation forcing is responsible for major climate changes, the cooperative phenomena between the frequency and amplitude of the insolation are defined as insolation pulsation. Coupling of the insolation frequency and amplitude variations has established an especially new and interesting series of insolation pulses. These pulses would modulate the insolation in such a way that the mode of insolation variations could be locked to generate the 100-kyr ice age cycle which is a long-time geophysical puzzle. The nonlinear behavior of insolation forcing is tested by energy balance and ice sheet climate models and the physical mechanism behind this forcing is explained in terms of pulse duration in the incoming solar radiation. Calculations of the solar energy flux at the top of the atmosphere show that the duration of the negative and positive insolation pulses is about 2 thousand years which is long enough to prolong glaciation into deep ice ages and cause rapid melting of large ice sheets in the high latitudes of the northern hemisphere. We have performed numerical simulations of climate response to nonlinear insolation forcing for the past 2 million years. Our calculated results of temperature fluctuations are in good agreement with the climate cycles as seen in the terrestrial biogenic silica (BDP-96-2) data as well as in the marine oxygen isotope (delta(sup 18)O) records.
Author
Nonlinear Systems; Nonlinearity; Insolation; Ice; Climate Change; Climate Models

19990103125 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Guideline for Developing an Ozone Forecasting Program
Dye, T. S.; MacDonald, C. P.; Anderson, C. B.; Jul. 1999; 98p
Report No.(s): PB99-168874; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche
The purpose of this document is to provide guidance to help air quality agencies develop, operate, and evaluate ozone forecasting programs. This guidance document provides: Background information about ozone and the weather's effect on ozone; A list of how ozone forecasts are currently used; A summary and evaluation of methods currently used to forecast ozone; and Steps you can follow to develop and operate an ozone forecasting program. The intended audience of this document is project managers, meteorologists, air quality analysts, and data analysts. Project managers can learn about the level of effort needed to set up and operate a forecasting program. Meteorologists can learn about the various methods to predict ozone and the steps needed to create a program.
NTIS
Statistical Weather Forecasting; Air Pollution; Air Quality; Pollution Control; Pollution Monitoring; Pollution Transport

19990103126 Environmental Protection Agency, Information Transfer and Program Integration Div., Research Triangle Park, NC USA
RACT/BACT/LAER Clearinghouse Clean Air Technology Center Annual Report for 1999: A Complication of Control Technology Determinations. Ninth Supplement to 1990 Edition
Jun. 1999; 578p; In English

Report No.(s): PB99-168908; EPA/456/R-99/004; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

The basic purposes of the RBLC are to: (1) provide state and local air pollution control agencies, industry, and the public with current information on case-by-case control technology determinations that are made nationwide, and (2) promote communication, cooperation, and sharing of control technology information among the permitting agencies. The information presented in this compilation was abstracted from preconstruction permits and submitted by the state and local air pollution control agencies and EPA regional offices. The Clearinghouse is intended as a reference for state and local agencies in making RACT/BACT/LAER decisions.
NTIS
Pollution Control; Complexity; Air Quality

19990103128 Office of Air Quality Planning and Standards, Research Triangle Park, NC USA
Small Entity Compliance Guide: National Volatile Organic Compound Emission Standards for Architectural Coatings
Final Report
Jul. 1999; 248p; In English
Report No.(s): PB99-169914; No Copyright; Avail: CASI; A11, Hardcopy; A03, Microfiche

The U.S. Environmental Protection Agency (EPA) published the regulation entitled 'National Volatile Organic Compound Emission Standards for Architectural Coatings' (Federal Register, Vol. 63, No. 176, pages 48848-48887) on September 111, 1998 under authority of Section 183(e) of the Clean Air Act. This guide explains how to tell if you are subject to the regulation and what to do if you are required to comply.
NTIS
Air Pollution; Pollution Transport; Air Quality; Pollution Control; Environment Protection

19990103592 NASA Goddard Space Flight Center, Greenbelt, MD USA
Observations of "Hystereris" in Backscattered Ultraviolet Ozone Data
DeLand, Matthew T., Raytheon STX Corp., USA; Cebula, Richard P., Raytheon STX Corp., USA; Huang, Liang–Kang, Raytheon STX Corp., USA; Taylor, Steven L., Raytheon STX Corp., USA; Stolarski, Richard S., NASA Goddard Space Flight Center, USA; McPeters, Richard D., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; NEWRAD 1999, 25-27 O t. 1999, Madrid, Spain; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The backscattered ultraviolet (BUV) technique has been used for almost 3 decades to monitor global total ozone and the distribution of ozone in the stratosphere. Satellite BUV measurements in the 250-340 mn wavelength region are technically challenging because the Earth's radiance varies by approximately 4 orders of magnitude during a single scan. Further, the observed signal increases by over three orders of magnitude in about 2 minutes as the satellite emerges into daylight. The gain of the instrument's photomultiplier tube (PMT) detector is low when the spacecraft first emerges into the sunlit portion of the orbit relative to the gain observed after the PMT has experienced moderately high current levels. This "hysteresis" effect was first observed on the Nimbus-7 SBUV and TOMS instruments. The effect is difficult to characterize prelaunch because of the high signal levels and rapid variations required. We have recently observed and quantified the hysteresis effect for the NOAA-9 SBUV/2 instrument, which collected ozone data from February 1985 to February 1998. The instrument gain is observed to be up to 3% low at high solar zenith angles [Chi = 85-90 degrees] in the emergent hemisphere (i.e. Southern Hemisphere at launch). The gain error decreases as the SZA decreases and average PMT current increases, and is generally negligible for Chi is less than 65 degrees. The magnitude of the hysteresis effect varies with season, and exhibits long-term changes as the NOAA-9 sun-synchronous orbit drifts. In the latter portion of the record, when the spacecraft emerged from the dark in the Northern Hemisphere, hysteresis effects were then observed in the North. NOAA-9 total ozone errors due to the hysteresis effect are typically on the order of 2%, but can reach 5% in extreme cases. We have developed a quantitative correction for the hysteresis effect that incorporates both seasonal and long-term variations in magnitude. Results of similar analyses for the NOAA-11 and NOAA-14 SBUV/2 instruments will also be discussed. The characterization of the hysteresis effect in high solar zenith angle SBUV/2 ozone data represents a significant step towards reconciling polar ozone measurements from different satellite instruments.
Author
Annual Variations; Backscattering; Hysteresis; Northern Hemisphere; Ozone; Satellite Instruments; Satellite Observation; Solar Position; Southern Hemisphere; Stratosphere; Ultraviolet Radiation

Interannual Variabilities in Tropical Tropospheric Ozone

Ziemke, Jerry R., NASA Goddard Space Flight Center, USA; Chandra, S., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper presents the first detailed characterization of interannual variability in tropical tropospheric column ozone (TCO) to delineate the relative importance of biomass burning and large-scale transport. TCO time series are derived from 20 years (1979-1998) of total ozone mapping spectrometer (TOMS) data using the convective cloud differential (CCD) method. Our study identifies three regions in the tropics with distinctly different characteristics related to interannual variability. These three regions are the eastern Pacific, Atlantic, and western Pacific. The Atlantic region indicates a quasi-biennial oscillation (QBO) in TCO which is out of phase with the QBO in stratospheric ozone. This is consistent with the photochemical control of this region by ozone-producing precursors. The observed pattern however does not seem to be related to interannual variability in ozone precursors related to biomass burning. Instead it appears to be a manifestation of the UV modulation of upper tropospheric chemistry on a QBO time scale caused by stratospheric ozone. During El Nino events there is anomalously low TCO in the eastern Pacific and high values in the western Pacific, indicating the effects of convectively-driven transport. The observed increase of 10-20 DU in TCO in the Indonesian region in the western Pacific during the recent 1997-1998 El Nino was associated with large-scale fires which may have contributed 5-10 DU of the total increase.
Author
Atmospheric Chemistry; Ozone; Photochemical Reactions; Stratosphere; Time Series Analysis; Tropical Regions; Troposphere; Variability; Climate; Periodic Variations

Middle Atmosphere Transport Properties of Assimilated Datasets

Pawson, Steven, Universities Space Research Association, USA; Rood, Richard, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

One of the most compelling reasons for performing data assimilation in the middle atmosphere is to obtain global, balanced datasets for studies of trace gas transport and chemistry. This is a major motivation behind the Goddard Earth observation System-Data Assimilation System (GEOS-DAS). Previous studies have shown that while this and other data assimilation systems can generally obtain good estimates of the extratropical rotational velocity field, the divergent part of the dynamical field is deficient; this impacts the "residual circulation" and leads to spurious trace gas transport on seasonal and interannual timescales. These problems are impacted by the quality and the method of use of the observational data and by deficiencies in the atmospheric general circulation model. Whichever the cause at any place and time, the "solution" is to introduce non-physical forcing terms into the system (the so-called incremental analysis updates); these can directly (thermal) or indirectly (mechanical) affect the residual circulation. This paper will illustrate how the divergent circulation is affected by deficiencies in both observations and models. Theoretical considerations will be illustrated with examples from the GEOS-DAS and from simplified numerical experiments. These are designed to isolate known problems, such as the inability of models to sustain a quasi-biennial oscillation and sparse observational constraints on tropical dynamics, or radiative inconsistencies in the presence of volcanic aerosols.
Author
Atmospheric Composition; Earth Observations (From Space); Gas Transport; Middle Atmosphere; Trace Elements; Transport Properties; Tropical Regions

Seasonal Variability of Middle Latitude Ozone in the Lowermost Stratosphere Derived from Probability Distribution Functions

Cerniglia, M. C., NASA Goddard Space Flight Center, USA; Douglass, A. R., NASA Goddard Space Flight Center, USA; Rood, R. B., NASA Goddard Space Flight Center, USA; Sparling, L. C.., NASA Goddard Space Flight Center, USA; Nielsen, J. E., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, Jul. 1999, Birmingham, UK; Sponsored by International Council of Scientific Unions; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We present a study of the distribution of ozone in the lowermost stratosphere with the goal of understanding the relative contribution to the observations of air of either distinctly tropospheric or stratospheric origin. The air in the lowermost stratosphere is divided into two population groups based on Ertel's potential vorticity at 300 hPa. High [low] potential vorticity at 300 hPa suggests that the tropopause is low [high], and the identification of the two groups helps to account for dynamic variability. Conditional probability distribution functions are used to define the statistics of the mix from both observations and model simulations. Two data sources are chosen. First, several years of ozonesonde observations are used to exploit the high vertical resolution. Sec-

ond, observations made by the Halogen Occultation Experiment [HALOE] on the Upper Atmosphere Research Satellite [UARS] are used to understand the impact on the results of the spatial limitations of the ozonesonde network. The conditional probability distribution functions are calculated at a series of potential temperature surfaces spanning the domain from the midlatitude tropopause to surfaces higher than the mean tropical tropopause [about 380K]. Despite the differences in spatial and temporal sampling, the probability distribution functions are similar for the two data sources. Comparisons with the model demonstrate that the model maintains a mix of air in the lowermost stratosphere similar to the observations. The model also simulates a realistic annual cycle. by using the model, possible mechanisms for the maintenance of mix of air in the lowermost stratosphere are revealed. The relevance of the results to the assessment of the environmental impact of aircraft effluence is discussed.

Author

Ozone; Stratosphere; Probability Distribution Functions; Temperate Regions; Temporal Distribution; Annual Variations

19990103607 NASA Goddard Space Flight Center, Greenbelt, MD USA

Physically-Derived Dynamical Cores in Atmospheric General Circulation Models

Rood, Richard B., NASA Goddard Space Flight Center, USA; Lin, Shian–Jiann, NASA Goddard Space Flight Center, USA; 1999; 1p; In English, Jul. 1999, Birmingham, UK; Sponsored by International Council of Scientific Unions; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The algorithm chosen to represent the advection in atmospheric models is often used as the primary attribute to classify the model. Meteorological models are generally classified as spectral or grid point, with the term grid point implying discretization using finite differences. These traditional approaches have a number of shortcomings that render them non-physical. That is, they provide approximate solutions to the conservation equations that do not obey the fundamental laws of physics. The most commonly discussed shortcomings are overshoots and undershoots which manifest themselves most overtly in the constituent continuity equation. For this reason many climate models have special algorithms to model water vapor advection. This talk focuses on the development of an atmospheric general circulation model which uses a consistent physically-based advection algorithm in all aspects of the model formulation. The shallow-water model is generalized to three dimensions and combined with the physics parameterizations of NCAR's Community Climate Model. The scientific motivation for the development is to increase the integrity of the underlying fluid dynamics so that the physics terms can be more effectively isolated, examined, and improved. The expected benefits of the new model are discussed and results from the initial integrations will be presented.

Author

Advection; Atmospheric General Circulation Models; Fluid Dynamics; Climatology; Atmospheric Circulation

19990103926 Earth Technology, Concord, MA USA

Critical Review of Four Types of Air Quality Models Pertinent to MMS Regulatory and Environmental Assessment Missions *Final Report*

Chang, J. C.; Fernau, M. E.; Scire, J. S.; Strimaitis, D. G.; Nov. 01, 1998; 192p; In English

Report No.(s): PB99-167363; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This report provides comparative information on several air quality models that might be used for four distinct purposes: Regional-scale Dispersion Models, Lagrangian Trajectory Models, Toxic Release Models, and Steady-state Gaussian Models. For each model reviewed, information is provided for each of 20 categories or attributes that describe the model's underlying science and credibility, ease of use, computational requirements, cost, availability, and computer language and interface. In addition to narrative information, each model is numerically rated for 17 of the 20 categories, leading to a ranking of candidate models suitable for the four purposes mentioned.

NTIS

Environment Models; Environment Effects; Air Quality; Air Pollution; Atmospheric Effects; Pollution Transport; Plumes; Atmospheric Diffusion

19990103938 Environmental Protection Agency, Air Pollution Prevention and Control Div., Research Triangle Park, NC USA

Solutions to Indoor Air Problems: Let's First Understand the Source

Osborne, M. C.; Tucker, W. G.; Cinalli, C. A.; Johnston, P. K.; 1999; 10p; In English

Report No.(s): PB99-171498; EPA/600/A-99/065; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The paper shows how EPA's Source Ranking Database (SRD) can be used, together with literature studies, to identify industrial product categories worthy of indoor air source characterization research. The SRD is a tool under development by EPA to

identify potentially hazardous indoor products. (NOTE: Many different products found in the indoor environment can contribute to indoor air quality problems).

NTIS

Indoor Air Pollution; Air Quality; Pollution Control; Pollution Monitoring

19990103953 NASA Goddard Space Flight Center, Greenbelt, MD USA

A Composite View of Lower Stratospheric Ozone Developed Using a Chemistry Transport Model and Observations from Airborne Lidar and Satellite

Douglass, A. R., NASA Goddard Space Flight Center, USA; Schoeberl, M. R., NASA Goddard Space Flight Center, USA; Browell, E. V., NASA Langley Research Center, USA; 1999; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

An ozone simulation from the Goddard three-dimensional chemistry and transport model for the 1995-96 northern hemisphere winter is compared with ozone observations from airborne Differential Absorption Lidar (DIAL), from the Polar Ozone and Aerosol Measurement (POAM), from the Microwave Limb Sounder (MLS), and from the Halogen Occultation Experiment (HALOE). The 3D model uses winds from the Goddard Data Assimilation System. The 3D model reproduces the latitude dependence of the horizontal and vertical ozone gradients of the subtropical DIAL observations. Comparisons with subtropical satellite observations, which lack the spatial resolution of DIAL but provide near continuous coverage throughout the subtropics, show that the model also reproduces longitude and temporal dependence in the tropical-midlatitude boundary. At polar latitudes, observations from DIAL flights on December 9 and January 30, and POAM and MLS between late December and late January are compared with the 3D model. Data from the three platforms consistently show that the observed ozone has a negative trend relative to the modeled ozone, and that the trend is uniform in time between early and mid winter, with no obvious dependence on proximity to the vortex edge.

Author

Atmospheric Composition; Northern Hemisphere; Ozone; Satellite Observation; Simulation; Stratosphere; Three Dimensional Models; Atmospheric Chemistry; Atmospheric Models

19990103954 NASA Goddard Space Flight Center, Greenbelt, MD USA

Sulfate and Pb-210 Simulated in a Global Model Using Assimilated Meteorological Fields

Chin, Mian, NASA Goddard Space Flight Center, USA; Rood, Richard, NASA Goddard Space Flight Center, USA; Lin, S.–J., NASA Goddard Space Flight Center, USA; Jacob, Daniel, Harvard Univ., USA; Muller, Jean–Francois, Belgian Inst. for Space Aeronomy, Belgium; 1999; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This report presents the results of distributions of tropospheric sulfate, Pb-210 and their precursors from a global 3-D model. This model is driven by assimilated meteorological fields generated by the Goddard Data Assimilation Office. Model results are compared with observations from surface sites and from multiplatform field campaigns of Pacific Exploratory Missions (PEM) and Advanced Composition Explorer (ACE). The model generally captures the seasonal variation of sulfate at the surface sites, and reproduces well the short-term in-situ observations. We will discuss the roles of various processes contributing to the sulfate levels in the troposphere, and the roles of sulfate aerosol in regional and global radiative forcing.

Author

Aerosols; Lead Isotopes; Sulfates; Three Dimensional Models; Troposphere

19990103955 NASA Goddard Space Flight Center, Greenbelt, MD USA

Calculations of Polar Ozone Loss Rates

Dessler, A. E., NASA Goddard Space Flight Center, USA; Wu, J., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Sponsored by American Geophysical Union; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We calculate vortex-averaged ozone loss rates at 465-K potential temperature during the Aug.-Sept. time period in the southern hemisphere and Feb.-Mar. time period in the northern hemisphere. Ozone loss rates are calculated two ways. First, from the time series of measurements of 03. Second, from measurements of ClO, from which ozone loss is inferred based on our theories of CL-catalyzed ozone destruction. Both measurement sets are from the Upper Atmosphere Research Satellite (UARS) Microwave Limb Sounder (MLS) instrument. We find good agreement between vortex-averaged ozone loss rates calculated from these methods. Our analysis provides no support for recent work suggesting that current theories of CL-catalyzed ozone loss underestimate the observed decrease in polar ozone during the ozone "hole" period.

Author

Ozone; Ozonometry; Ozone Depletion; Chlorine; Chlorine Oxides

NASA Goddard Space Flight Center, Greenbelt, MD USA

Clouds, Rain, and the Global Climate: What are we Learning from the Tropical Rainfall Measuring Mission (TRMM)?

Kummerow, Chris, NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 5 Oct. 1999, Hampton, VA, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Tropical rainfall is important in the hydrological cycle and to the lives and welfare of humans. In addition to being a life-giving resource, tropical rainfall also plays a crucial role in the dynamics of the global atmospheric circulation. Three-fourths of the energy that drives the atmospheric wind circulation comes from the latent heat released by tropical precipitation. It varies greatly in space and time. The rain-producing cloud systems may last several hours or days. Their dimensions range from 10 km to several hundred km. This makes it difficult to incorporate rainfall directly large-scale weather and climate models. Until the end of 1997, precipitation in the global tropics was not known to within a factor of two. Regarding "global warming", the various large-scale models differed among themselves in the predicted magnitude of the warming and in the expected regional effects of these temperature and moisture changes. Accurate estimates of tropical precipitation and the associated latent heat release were urgently needed to improve these models. The Tropical Rainfall Measuring Mission (TRMM) satellite,h&s yielded important interim results after nearly two years of successful flight operations since launch in late 1997. This talk will summarize the questions and where the TRMM science team is with regards to answering some of these important scientific challenges.
Author

Rain; Clouds (Meteorology); Climatology; Weather; Tropical Regions; Hydrological Cycle; Heat Transfer

NASA Goddard Space Flight Center, Greenbelt, MD USA

Remote Sensing of Aerosol and their Radiative Forcing of Climate

Kaufman, Yoram J., NASA Goddard Space Flight Center, USA; Tanre, Didier, Lille Univ., France; Remer, Lorraine A., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 11 Oct. 1999, Tacoma, WA, USA; Sponsored by American Association for Aerosol Research, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Remote sensing of aerosol and aerosol radiative forcing of climate is going through a major transformation. The launch in next few years of new satellites designed specifically for remote sensing of aerosol is expected to further revolutionized aerosol measurements: until five years ago satellites were not designed for remote sensing of aerosol. Aerosol optical thickness was derived as a by product, only over the oceans using one AVHRR channel with errors of approx. 50%. However it already revealed a very important first global picture of the distribution and sources of aerosol. In the last 5 years we saw the introduction of polarization and multi-view observations (POLDER and ATSR) for satellite remote sensing of aerosol over land and ocean. Better products are derived from AVHRR using its two channels. The new TOMS aerosol index shows the location and transport of aerosol over land and ocean. Now we anticipate the launch of EOS-Terra with MODIS, MISR and CERES on board for multi-view, multi-spectral remote sensing of aerosol and its radiative forcing. This will allow application of new techniques, e.g. using a wide spectral range (0.55-2.2 microns) to derive precise optical thickness, particle size and mass loading. Aerosol is transparent in the 2.2 microns channel, therefore this channel can be used to detect surface features that in turn are used to derive the aerosol optical thickness in the visible part of the spectrum. New techniques are developed to derive the aerosol single scattering albedo, a measure of absorption of sunlight, and techniques to derive directly the aerosol forcing at the top of the atmosphere. In the last 5 years a global network of sun/sky radiometers was formed, designed to communicate in real time the spectral optical thickness from 50-80 locations every day, every 15 minutes. The sky angular and spectral information is also measured and used to retrieve the aerosol size distribution, refractive index, single scattering albedo and the spectral flux reaching the surface. Effort to introduce remote sensing from lidars will literally additional dimension to aerosol remote sensing. The vertical dimension is a critical link between the global satellite observations and modeling of aerosol transport. Lidars are also critical to study aerosol impact on cloud microphysics and reflectance. Both lidar ground networks and satellite systems are in development. This new capability is expected to put remote sensing in the forefront of aerosol and climate studies. Together with field experiments, chemical analysis and chemical transport models we anticipate, in the next decade, to be able to resolve some of the outstanding questions regarding the role of aerosol in climate, in atmospheric chemistry and its influence on human health and life on this planet.
Author

Aerosols; Remote Sensing; Climate; Atmospheric Chemistry; Chemical Analysis; Size Distribution

NASA Goddard Space Flight Center, Greenbelt, MD USA

Evaluation of Dust Absorption and Radiative Forcing of Climate Using Satellite and Ground Based Remote Sensing

Kaufman, Yoram J., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 6 Oct. 1999, NY, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Simultaneous spaceborne and ground based measurements of the scattered solar radiation, create a powerful tool for determination of dust absorption. Absorption of solar radiation is a key component in understanding dust impact on radiative forcing

at the top of the atmosphere, on the temperature profile and on cloud formation. We use LANDSAT spaceborne measurements at seven spectral channels in the range of 0.47 to 2.2 microns over Senegal with corresponding measurements of the aerosol spectral optical thickness by ground based sunphotometers, to find that Saharan dust absorption of solar radiation is two to four times smaller than measured in situ and represented in models. Though dust was found to absorb in the blue (single scattering albedo wo = 0.88), almost no absorption, wo = 0.98, was found for 1 greater than 0.6 microns. The results are in agreement with dust radiative measurements reported in the literature, and explain some previously reported but unexplained dust radiative properties. Therefore, the new finding should be of general relevance. The new finding increases by 50% recently estimated solar radiative forcing by dust at the top of the atmosphere and decreases the estimated dust heating of the lower troposphere due to absorption of solar radiation. Dust transported from Asia shows slightly higher absorption for wavelengths under 1 @im, that can be explained by the presence of black carbon from urban/industrial pollution associated with the submicron size mode.
Author

Evaluation; Dust; Solar Radiation; Atmospheric Temperature; Climate; Radiation Absorption; Remote Sensing; Scattering

19990104391 Chemical Lime Co., Marble Falls, TX USA

Lime Kiln Source Characterization. Lime Manufacturing Industry Fourier Transform Infrared Spectroscopy *Final Report*

Toney, M. L.; Jul. 1999; 76p; In English

Report No.(s): PB99-169245; EPA/454/R-99/030; No Copyright; Avail: National Technical Information Service (NTIS), Hardcopy

The purpose of this testing program is to obtain uncontrolled and controlled hydrogen chloride (HCI) and speciated hydrocarbon Hazardous Air Pollutants (HAPs) emissions data from lime production plants to support a national emission standard for hazardous air pollutants (NESHAP). This report presents data from the Fourier Transform Infrared Spectroscopy (FTIR) measurements. FTIR source testing was conducted for the following purposes: Quantify HCI emission levels; and Gather screening (i.e., qualitative) data on other HAP emissions.
NTIS

Infrared Spectroscopy; Calcium Oxides; Infrared Spectra; Pollution Monitoring; Fourier Transformation

19990104611 Army Construction Engineering Research Lab., Champaign, IL USA

Reducing Air Pollutant Emissions From Solvent Multi-Base Propellant Production *Final Report*

Kemme, Michael R.; Lateulere, Michael; Maloney, Stephen W.; Aug. 1999; 85p; In English

Contract(s)/Grant(s): Proj-D048

Report No.(s): AD-A367284; CERL-TR-99/71; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The Radford Army Ammunition Plant, Virginia, is the multi-base propellant manufacturing facility for the Department of Defense (DoD). Solvent multi-base propellant production, however, emits large quantities of volatile organic compounds (VOCs). These VOC emissions are regulated under title I of the Clean Air Act as precursors of tropospheric ozone. The pollutant stream also contains low concentrations of nitroglycerine (NG). The NG content prohibits the use of traditional air pollution control technologies because of safety concerns. This report summarizes the research of CERL and others into alternative air pollution control technologies. Bench-scale tests of sulfuric acid scrubbing, sorptive slurry biodegradation, and ultraviolet (UV) photocatalytic oxidation were conducted. The results of the UV photocatalytic oxidation tests showed the most promise based on safety, economic, and operational considerations and the remaining research effort focused on this technology. UV photocatalytic oxidation was tested on a larger scale to determine its effectiveness. This report describes the results of the larger scale testing and presents a demonstration protocol that can be applied to future full-scale work.
DTIC

Air Pollution; Clean Energy; Air Quality; Pollution Control; Pollution Monitoring; Exhaust Emission; Organic Compounds

19990106309 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Role of Data Assimilation in the Study of Regional and Global Variability of the Hydrological Cycle

Schubert, Siegfried, NASA Goddard Space Flight Center, USA; Chang, Yehui, NASA Goddard Space Flight Center, USA; Chen, Tsing–Chang, Iowa State Univ. of Science and Technology, USA; 1999; 1p; In English; 2nd; Reanalyses, 23-27 Aug. 1999, Reading, UK; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In the coming years, researchers will have at their disposal a host of new observations from advanced space-based sensors (e.g. the Tropical Rainfall Measuring Mission, EOS Terra and PM missions) providing, among other things, a more complete and accurate description of various components of the Earth's hydrological cycle. Also, increasingly more sophisticated and comprehensive geophysical models will provide researchers better tools for simulating the hydrological cycle, and for carrying out mech-

anistic studies of the role of moist processes in the climate system. In addition, new data sets generated with global four-dimensional data assimilation (4DDA) systems will provide comprehensive and complete information on both the state and forcing of the climate system. Ideally, the 4DDA systems optimally incorporate all relevant information from the observations together with a first guess from a state-of-the-art geophysical model to produce a "best" estimate of the climate state. Furthermore, to the extent that the assimilating models are realistic and are constrained by the observations, they should provide reliable estimates of the associated physical processes or climate forcing fields. While operational weather centers now have a considerable history of providing reliable estimates of the basic atmospheric state variables, the associated processes or diagnostic fields (which are less well constrained by the observations and sensitive to errors in the model's physical parameterizations) are still considered experimental and of uncertain quality. In this study we will examine the current generation of reanalysis products to assess the capabilities of 4DDA systems to represent components of the hydrological cycle. The focus is on the role of the model in providing consistent estimates of moist processes. We will also assess whether current observations provide sufficient constraints on these model- generated fields.
Author

Climate; Data Systems; Hydrological Cycle; Weather; Climatology; Hydroclimatology; Hydrology Models; Climate Models; Precipitation (Meteorology)

19990106310 NASA Goddard Space Flight Center, Greenbelt, MD USA

Seasonal Predictions with the GEOS GCM

Schubert, Siegfried, NASA Goddard Space Flight Center, USA; Chang, Yehui, NASA Goddard Space Flight Center, USA; Suarez, Max, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Reanalyses, 23-27 Aug. 1999, Reading, UK; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A number of ensembles of seasonal forecasts have recently been completed as part of NASA's Seasonal to Interannual Prediction Project (NSIPP). The focus is on the extratropical response of the atmosphere to observed Surface Sea Temperature (SST) anomalies during boreal winter. The prediction experiments consist of nine forecasts starting from slightly different initial conditions for each year of the 15 year period 1981-95, employing version 2 of the Goddard Earth Observing System (GEOS) atmospheric Global Circulation Models (GCM). The initial conditions are obtained from the NASA GEOS-1 reanalysis data. Comparisons with a companion set of six long-term simulations with observed SST (starting in 1978, so they have no memory of the initial conditions for the periods of interest) are used to assess the relative contributions of the initial conditions and SST anomalies to forecast skill ranging from daily to seasonal time scales. The ensembles are used to isolate the signal, and to assess the nature of the inherent variability (noise) of the forecasts.
Author

Atmospheric Circulation; Sea Surface Temperature; Atmospheric General Circulation Models; Weather Forecasting; Climatology; Annual Variations; Meteorology

<div align="center">

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GEOPHYSICS

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Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism. For space radiation see 93 Space Radiation.

19990099700 NASA Marshall Space Flight Center, Huntsville, AL USA

The Relationship of Ion Beams and Fast Flows in the Plasma Sheet Boundary Layer

Parks, G. K., NASA Marshall Space Flight Center, USA; Reme, H., NASA Marshall Space Flight Center, USA; Lin, R. P., NASA Marshall Space Flight Center, USA; Sanderson, T., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, James F., Jr., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., NASA Marshall Space Flight Center, USA; McCarthy, M., NASA Marshall Space Flight Center, USA; Chen, L. J., NASA Marshall Space Flight Center, USA; Larsen, D., NASA Marshall Space Flight Center, USA; Phan, T. D., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; 4th; International Conference on Substorms, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We report new findings on the behavior of plasmas in the vicinity of the plasma sheet boundary layer (PSBL). A large geometrical factor detector on WIND (3D plasma experiment) has discovered a unidirectional ion beam streaming in the tailward direction missed by previous observations. This tailward beam is as intense as the earthward streaming beam and it is found just inside the outer edge of the PSBL where earthward streaming beams are observed. The region where this tailward beam is observed includes an isotropic plasma component which is absent in the outer edge where earthward streaming beams are found. When these

different distributions are convolved to calculate the velocity moments, fast flows (greater than 400 km/s) result in the earthward direction and much slower flows (less than 200 km/s) in the tailward direction. These new findings are substantially different from previous observations. Thus, the interpretation of fast flows and earthward and counterstreaming ion beams in terms of a neutral line model must be reexamined.
Author
Ion Beams; Plasma Layers; Boundary Layers

19990100647 NASA Goddard Space Flight Center, Greenbelt, MD USA
Parameterizations of Depositional Growth of Cloud Ice in a Bulk Microphysical Scheme
Braun, Scott A., NASA Goddard Space Flight Center, USA; Ferrier, Brad S., Maryland Univ. Baltimore County, USA; Tao, Wei–Kuo, NASA Goddard Space Flight Center, USA; Sep. 17, 1999; 36p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Two aspects of the cloud ice parameterization in the Goddard Cumulus Ensemble Model cloud physics parameterization are examined: the conversion of cloud ice to snow by depositional growth, designated PSFI, and the saturation adjustment scheme. The original formulation of PSFI is shown to produce excessive conversion of cloud ice to snow because of an implicit assumption that the relative humidity is 100% with respect to water even though the air may actually be quite less humid. Two possible corrections to this problem are proposed, the first involving application of a relative humidity dependent correction factor to the original formulation of PSFI, and the second involving a new formulation of PSFI based on the equation for depositional growth of cloud ice. The sensitivity of these formulations of PSFI to the assumed masses of the ice particles is examined. Possible problems associated with using a saturation adjustment scheme for cloud ice are discussed and simulations of a squall line with and without application of the adjustment scheme for ice are compared.
Author
Cloud Physics; Cumulus Clouds; Ice; Ice Clouds; Snow; Ice Formation

19990100864 Alabama Univ., Dept. of Civil and Environmental Engineering, Huntsville, AL USA
Sand Shear Band Thickness Measurements by Digital Imaging Techniques
Alshibli, Khalid A., Alabama Univ., USA; Sture, Stein, Colorado Univ., USA; 1998; In English
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Digital imaging analysis was used to study localized deformations in granular materials tested under plane strain condition. Two independent techniques were applied and compared. In the first, the digitized optical images of a grid printed on the latex membrane were used to measure the shear band orientation angle and thickness, and were found to be 54.5' and 3.01 mm respectively. The second technique involved introducing an ultra-low viscosity resin into the specimen in preparation for thin- sectioning and microscopic study of the internal fabric. A total of 24 microscopic images obtained from four thin sections were analyzed and void ratio variation was measured. The shear band thickness measurements from images located along the shear band axis (at two locations) were equal to 3.19 mm and 3.29 mm which are very close to the average value obtained from surface analysis. The study was then extended to investigate the effects of sand grain-size and properties, specimen density, and confining pressure on shear band thickness. It was found that the normalized shear band thickness decreases as grain-size and confining pressure increase and as density decreases. Finally, shear band thickness is highly influenced by the specimen dilatancy.
Author
Thickness; Granular Materials; Deformation; Digital Techniques; Imaging Techniques; Sands

19990100877 NASA Marshall Space Flight Center, Huntsville, AL USA
Polar Cap Plasma and Convection
Elliott, Heather A., Alabama Univ., USA; Craven, Paul D., NASA Marshall Space Flight Center, USA; Comfort, Richard H., Alabama Univ., USA; Chandler, Michael O., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Goddard Space Flight Center, USA; Ruohoniemi, J. M., Johns Hopkins Univ., USA; 1998; 1p; In English, 26 Oct. 1998, Guntersville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This presentation will describe the character of the polar cap plasma in 10% AGU Spring 1998 particular the convection velocities at the perigee (about 1.8 Re) and apogee(about 8.9 Re) of Polar in relationship to Interplanetary Magnetic Field (IMF) and solar wind parameters. This plasma is thought to be due to several sources; the polar wind, cleft ion fountain, and auroral outflow. The plasma in the polar cap tends to be mostly field-aligned. At any given point in the polar cap, this plasma could be from a different regions since convection of magnetic field lines can transport this material. it is quite difficult to study such a phenomena with single point measurements. Current knowledge of the polar cap plasma obtained by in situ measurements will be presented along with recent results from the Polar mission. This study also examines the direct electrical coupling between the

magnetosphere and ionosphere by comparing convection velocities measured by the Thermal Ion Dynamics Experiment (TIDE) and Magnetic Field Experiment (MFE) instruments in magnetosphere and measurements of the ionosphere by ground-based radars. At times such a comparison is difficult because the Polar satellite at apogee spends a large amount of time in the polar cap which is a region that is not coverage well by the current SuperDam coherent radars. This is impart due to the lack of irregularities that returns the radar signal.

Author

Plasma Dynamics; Plasmas (Physics); Polar Caps; Interplanetary Magnetic Fields; Solar Wind; Convection; Magnetosphere-Ionosphere Coupling

19990100917 NASA Marshall Space Flight Center, Huntsville, AL USA

Evidence for Directly Driven Auroral Signatures Resulting from Interplanetary Pressure Pulses

Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., Washington Univ., USA; Parks, G. K., Washington Univ., USA; Germany, G. A., Alabama Univ., USA; [1999]; 1p; In English, 30 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

It has been observed that the auroral signature of the arrival of an interplanetary pressure pulse at the bow shock causes an initial brightening near noon. Consequently, the bright region propagates to the night side via the dawn and dusk flanks. The delay time for subsequent auroral breakup is observed to vary significantly from seconds to hours. We have examined the 1998 and early 1999 interplanetary pressure pulse events recorded by WIND and ACE (over 35 in all) and correlated these with the Polar UVI data for the events that are imaged. Evidence for directly driven auroral activity resulting from an interplanetary pressure pulse will be discussed as well as the variation of the delay time for auroral breakup.

Author

Observation; Auroras; Pressure Pulses; Interplanetary Gas

19990100919 NASA Marshall Space Flight Center, Huntsville, AL USA

Dynamics of the Auroral Luminosity Boundary of the Polar Cap During Substorms

Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Chua, D., NASA Marshall Space Flight Center, USA; Fillingim, M. O., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Spann, James F., Jr., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; 1999; In English; 22nd, 18-30 Jul. 1999, Birmingham, UK; Sponsored by International Council of Scientific Unions, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The area of the polar cap during substorms has been measured using images from the Polar Ultraviolet Imager (UVI) for different interplanetary magnetic field (IMF) conditions. Changes in the poleward boundary of auroral luminosity have been analyzed in relation to substorm phase and IMF orientation. Reconnection models of flux transport into the polar cap during the substorm growth phase, and loss from the polar cap during the expansion phase, provide a framework by which these UVI observations can be analyzed. by comparison of the observations with the model predictions we can determine to what extent these models accurately predict the polar cap dynamics, and also where anomalous behavior calls for a new understanding of the dynamics beyond what these models provide. It was found that the polar cap boundary near noon and midnight usually shifted down in latitude by 1-2 degrees and 3-4 degrees respectively, increasing the area of the polar cap during the substorm growth phase as predicted. However, this growth phase phenomenon also unexpectedly occurs independently of the IMF Bz component, as shown for a substorm on January 9, 1997. The polar cap area also increased due to motion of the dawn and dusk aurora to lower latitudes, although the latitudinal shifts were asymmetric, not always concurrent, and continued well into the substorm expansion phase. The polar cap area decreased immediately following the expansion phase due to the poleward motion of the aurora on the nightside, consistent with the model prediction. What is not explained by the models is that the poleward auroral boundary in the nightside region sometimes reached very high latitudes (greater than 80 degrees MLat) greatly decreasing the polar cap area, independent of the magnitude of the substorm.

Author

Polar Caps; Auroras; Luminosity; Boundaries; Magnetic Storms

19990100921 NASA Marshall Space Flight Center, Huntsville, AL USA

Ionospheric response to the CME Passage of September 24,1998

Craven, Paul D, NASA Marshall Space Flight Center, USA; Spann, James F., Jr., NASA Marshall Space Flight Center, USA; Chandler, Michael O., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Marshall Space Flight Center, USA; 1999; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

On September 24, 1998, a solar coronal mass ejection struck the Earth's magnetosphere. The magnetosphere/ionosphere system exhibited a response in several ways one of which was an increase in ion outflow from the ionosphere, ionospheric mass ejections in response to the pressure pulse from the shock passage at the front of the magnetosphere. However, the timing of the incidence of the pressure pulse and the ionospheric response has not been examined in detail. Images from the Ultraviolet Imager show a brightening in the dayside aurora at the same time the shock is seen at Polar at about 23:45 UT on the 24th. . We examine the temporal and spatial relationship (using simple models) of these two events to determine the correlation of the particles seen at Polar and the regions of increased energy input seen in the aurora and discuss the physical implications of the results.
Author

Ionospherics; Coronal Mass Ejection; Solar Corona

19990100922 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermal Electron Results from the CAPER Sounding Rocket
Coffey, Victoria N., NASA Marshall Space Flight Center, USA; Chandler, Michael O., NASA Marshall Space Flight Center, USA; Pollock, Craig J., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Marshall Space Flight Center, USA; 1999; In English, 30 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Cleft Accelerated Plasma Experiment Rocket (CAPER) sounding rocket launched on January 21, 1999 at 06:13:30 UT into the cusp. Ion outflows and strong electric fields were present. We will present the preliminary results of the thermal electron detector, TECHS that was on this payload.
Author

Rocket Sounding; Sounding Rockets; Electron Counters

19990101872 Michigan Univ., Dept. of Atmospheric, Oceanic and Space Sciences, Ann Arbor, MI USA
High Resolution Doppler Imager *Final Report, 1 Apr. 1996 - 31 Mar. 1999*
Hays, Paul B., Michigan Univ., USA; October 1999; 16p; In English
Contract(s)/Grant(s): NAG5-3180; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report summarizes the accomplishments of the High Resolution Doppler Imager (HRDI) on UARS spacecraft during the period 4/l/96 - 3/31/99. During this period, HRDI operation, data processing, and data analysis continued, and there was a high level of vitality in the HRDI project. The HRDI has been collecting data from the stratosphere, mesosphere, and lower thermosphere since instrument activation on October 1, 1991. The HRDI team has stressed three areas since operations commenced: 1) operation of the instrument in a manner which maximizes the quality and versatility of the collected data; 2) algorithm development and validation to produce a high-quality data product; and 3) scientific studies, primarily of the dynamics of the middle atmosphere. There has been no significant degradation in the HRDI instrument since operations began nearly 8 years ago. HRDI operations are fairly routine, although we have continued to look for ways to improve the quality of the scientific product, either by improving existing modes, or by designing new ones. The HRDI instrument has been programmed to collect data for new scientific studies, such as measurements of fluorescence from plants, measuring cloud top heights, and lower atmosphere H2O.
Author

Doppler Radar; Image Converters; Data Acquisition; Data Processing; High Resolution

19990101880 NASA Marshall Space Flight Center, Huntsville, AL USA
Solar Wind-Magnetosphere Coupling Influences on Pseudo-Breakup Activity
Fillingim, M. O., Washington Univ.; Brittnacher, M., Washington Univ.; Parks, G. K., Washington Univ.; Germany, G. A., Alabama Univ., USA; Spann, J. F., NASA Marshall Space Flight Center, USA; 1998; In English, 28 Oct. 1998, Huntsville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Pseudo-breakups are brief, localized aurora[arc brightening, which do not lead to a global expansion, are historically observed during the growth phase of substorms. Previous studies have demonstrated that phenomenologically there is very little difference between substorm onsets and pseudo-breakups except for the degree of localization and the absence of a global expansion phase. A key open question is what physical mechanism prevents a pseudo-breakup form expanding globally. Using Polar Ultraviolet Imager (UVI) images, we identify periods of pseudo-breakup activity. Foe the data analyzed we find that most pseudo-breakups occur near local midnight, between magnetic local times of 21 and 03, at magnetic latitudes near 70 degrees, through this value may change by several degrees. While often discussed in the context of substorm growth phase events, pseudo-breakups are also shown to occur during prolonged relatively inactive periods. These quiet time pseudo-breakups can occur over a period of several hours without the development of a significant substorm for at least an hour after pseudo-breakup activity stops. In an attempt to understand the cause of quiet time pseudo-breakups, we compute the epsilon parameter as a measure of the efficiency

of solar wind-magnetosphere coupling. It is noted that quiet time pseudo-breakups occur typically when epsilon is low; less than about 50 GW. We suggest that quiet time pseudo-breakups are driven by relatively small amounts of energy transferred to the magnetosphere by the solar wind insufficient to initiate a substorm expansion onset.

Author

Solar Wind; Coupling; Planetary Magnetospheres

19990102211 NASA Marshall Space Flight Center, Huntsville, AL USA

Magnetospheric Response to the Arrival of the Shock Wave in Front of the Magnetic Cloud Event of January 10,1997

Wuest, M., Southwest Research Inst., USA; Huddleston, M., Southwest Research Inst., USA; Burch, J. L., Southwest Research Inst., USA; Dempsey, D. L., Southwest Research Inst., USA; Craven, P. D., NASA Marshall Space Flight Center, USA; Chandler, M. O., NASA Marshall Space Flight Center, USA; Spann, J. F., NASA Marshall Space Flight Center, USA; Peterson, W. K., Lockheed Martin Corp., USA; Collins, H. L., Lockheed Martin Corp., USA; Lennartsson, W., Lockheed Martin Corp., USA; 1998; 1p; In English; 32nd; Scientific Assembly: Advances in Auroral Plasma Physics, 12-19 Jul. 1998, Nagoya, Japan; Sponsored by Committee on Space Research; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We are studying the magnetic cloud event of January 6-11, 1997. Specifically, we have investigated the response of the magnetosphere to the shock wave in front of the magnetic cloud on January 10, 1997 using data from WIND, GEOTAIL and POLAR spacecraft as well as ground magnetometer data. The WIND spacecraft, which was located at about 100 Re upstream from the Earth, observed the arrival of the shock wave front at 005OUT. Geotail was located at the equatorial magnetopause (approx. 8.7 Re), while POLAR was located in the northern dawn sector at 8.4 Re, 6.1 MLT and 61.1 MLAT. A magnetic signature was nearly simultaneously observed at about 0104 UT at the POLAR and Geotail spacecraft. Particle density increases were observed on WIND and Geotail, but not on POLAR. The UV aurora shows an asymmetrical dawn-dusk intensification and presubstorm activity. The significance of these findings will be discussed.

Author

Magnetospheres; Shock Waves; Magnetic Clouds; Data Acquisition

19990102212 NASA Marshall Space Flight Center, Huntsville, AL USA

Multi-Instrument Analysis of a Traveling Convection Vortex Event on July 24, 1996 Coordinated with the Polar UVI

Sitar, R. J., NASA Marshall Space Flight Center, USA; Clauer, C. R., NASA Marshall Space Flight Center, USA; Baker, J. B., NASA Marshall Space Flight Center, USA; Ridley, A. J., NASA Marshall Space Flight Center, USA; Cumnock, J., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We present the analysis of a coordinated set of observations from the POLAR Ultraviolet Imager (UVI), ground magnetometers, incoherent scatter radar, solar wind monitors, DMSP and GOES satellites, focused on a traveling convection vortex (TCV) event on 24th July 1996. Starting at approximately 10:48 UT, around magnetometers in Greenland and northern Canada observe pulsations consistent with the passing overhead of a series of alternating TCV filed-aligned current pairs. Azimuthal scans by the Sondrestrom incoherent scatter radar located near Kangerlussuaq (formerly Sondrestrom), Greenland, at this time show strong modulation in the strength and direction of ionospheric plasma flow. The magnetometer pulsations grow in magnitude over the next hour, peaking in intensity at 11:39 UT, at which time images form the UVI instrument show a localized intensification of auroral emissions over central and western Greenland. Subsequent images show the intensification grow in strength and propagate westward (tailward) until approximately 11:58 UT at which time the intensification fades. These observations are consistent with the westward passage of two pairs of moderately intense TCVs over central Greenland followed by a third very intense TCV pair. The intensification of auroral emissions at 11:39 UT is associated with the trailing vortex of the third TCV pair, thought to be the result of an upward field aligned current. The modulated flow observed by the radar is the result of the strong electric fields associated with the impulsive TCV related field aligned current systems as they pass through the field of view of the radar. Measurements of the solar wind from the V;IND and IMP-8 spacecraft suggest that a pressure change may be responsible for triggering the first two pairs of TCVS, and that a subsequent sudden change in the orientation of the interplanetary magnetic field may have produced the intensification of the third TCV pair and the associated auroral brightening. Magnetometer data from the GOES satellite located over the eastern USA at geostationary orbit is consistent with a series of field-aligned moving tailward past the satellite. DMSP particle data indicated that the TCVs occur on field lines which map to the boundary plasma sheet (BPS).

Author

Azimuth; Electric Fields; Geosynchronous Orbits; Incoherent Scatter Radar; Interplanetary Magnetic Fields; Magnetohydrodynamic Flow; Magnetometers; Meteorological Radar

19990102213 NASA Marshall Space Flight Center, Huntsville, AL USA

Magnetotail Flow Bursts: Association to Global Magnetospheric Circulation, Relationship to Ionospheric Activity and Direct Evidence for Localization

Angelopoulos, V., NASA Marshall Space Flight Center, USA; Phan, T. D., NASA Marshall Space Flight Center, USA; Larson, D. E., NASA Marshall Space Flight Center, USA; Mozer, F. S., NASA Marshall Space Flight Center, USA; Lin, R. P., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A series of bursty bulk flow events (BBFs) were observed by GEOTAIL and WIND in the geomagnetotail. IMP8 at the solar wind showed significant energy coupling into the magnetosphere, while the UVI instrument of POALR evidenced significant energy transfer to the ionosphere during two substorms. There was good correlation between BBFs and ionospheric activity observed by UVI even when ground magnetic signatures were absent, suggesting that low ionospheric conductivity at the active sector may be responsible for this observation. During the second substorm no significant flux transport was evidenced past WIND in stark contrast to GEOTAIL and despite the small intersatellite separation ((3.54, 2.88, -0.06) Re). Throughout the intervals studied there were significant differences in the individual flow bursts at the two satellites, even during longitudinally extended ionospheric activations. We conclude that the half-scale-size of transport bearing flow bursts is less than 3 Re.
Author

Bursts; Magnetic Signatures; Ionospheres; Energy Transfer; Geomagnetic Tail

19990102858 NASA Marshall Space Flight Center, Huntsville, AL USA

Coupling between Close-Packed Shield Cassegrain Antennas

Padin, S., California Inst. of Tech., USA; Cartwright, J. K., California Inst. of Tech., USA; Joy, M., NASA Marshall Space Flight Center, USA; Nov. 27, 1998; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Design and performance details are given for a 0.9 m diameter shielded cassegrain antenna which will be used in a 13-element close-packed array. The array is designed make images of brightness fluctuations in the cosmic microwave background radiation. Coupling between a pair of the shielded cassegrain antennas with a separation of 1 m is in the range -110 to -130 dB over the 26-36 GM band.
Author

Design Analysis; Performance Tests; Cassegrain Antennas; Arrays

19990102888 NASA Goddard Space Flight Center, Greenbelt, MD USA

Recent Development on O(+) - O Collision Frequency and Ionosphere-Thermosphere Coupling

Omidvar, K., NASA Goddard Space Flight Center, USA; Menard, R., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The collision frequency between an oxygen atom and its singly charged ion controls the momentum transfer between the ionosphere and the thermosphere. There has been a long standing discrepancy, extending over a decade, between the theoretical and empirical determination of this frequency: the empirical value of this frequency exceeded the theoretical value by a factor of 1.7. Recent improvements in theory were obtained by using accurate oxygen ion-oxygen atom potential energy curves, and partial wave quantum mechanical calculations. We now have applied three independent statistical methods to the observational data, obtained at the MIT/Millstone Hill Observatory, consisting of two sets A and B. These methods give results consistent with each other, and together with the recent theoretical improvements, bring the ratio close to unity, as it should be. The three statistical methods lead to an average for the ratio of the empirical to the theoretical values equal to 0.98, with an uncertainty of +/-8%, resolving the old discrepancy between theory and observation. The Hines statistics, and the lognormal distribution statistics, both give lower and upper bounds for the Set A equal to 0.89 and 1.02, respectively. The related bounds for the Set B are 1.06 and 1.17. The average values of these bounds thus bracket the ideal value of the ratio which should be equal to unity. The main source of uncertainties are errors in the profile of the oxygen atom density, which is of the order of 11%. An alternative method to find the oxygen atom density is being suggested.
Author

Collision Rates; Momentum Transfer; Oxygen Atoms; Oxygen Ions; Thermosphere; Earth Ionosphere; Coupling

19990102889 NASA Goddard Space Flight Center, Greenbelt, MD USA

Some Peculiar Properties of Magnetic Clouds as Observed by the WIND Spacecraft

Berdichevsky, D., NASA Goddard Space Flight Center, USA; Lepping, R. P., NASA Goddard Space Flight Center, USA; Szabo,

A., NASA Goddard Space Flight Center, USA; Burlaga, L. F., NASA Goddard Space Flight Center, USA; Thompson, B. J., NASA Goddard Space Flight Center, USA; Lazarus, A. J., NASA Goddard Space Flight Center, USA; Steinburg, J. T., NASA Goddard Space Flight Center, USA; Mariani, F., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 31 May - Jun. 4 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We aimed at understanding the common characteristics of magnetic clouds, relevant to solar-interplanetary connections, but exceptional ones were noted and are stressed here through a short compendium. The study is based on analyses of 28 good or better events (Out of 33 candidates) as identified in WIND magnetic field and plasma data. These cloud intervals are provided by WIND-MFI's Website under the URL (http://lepmfi.gsfc.nasa.gov/mfi/mag_cloud_publ.html#table). The period covered is from early 1995 to November 1998. A force free, cylindrically symmetric, magnetic field model has been applied to the field data in usually 1-hour averaged form for the cloud analyses. Some of the findings are: (1) one small duration event turned out to have an approximately normal size which was due to a distant almost "skimming" passage by the spacecraft; (2) One truly small event was observed, where 10 min averages had to be used in the model fitting; it had an excellent model fit and the usual properties of a magnetic cloud, except it possessed a small axial magnetic flux; (3) One cloud ha a dual axial-field-polarity, in the sense that the "core" had one polarity and the annular region around it had an opposite polarity. This event also satisfied the model and with a ve3ry good chi-squared value. Some others show a hint of this dual polarity; (4) The temporal distribution of occurrence clouds over the 4 years show a dip in 1996; (5) About 50 % of the clouds had upstream shocks; any others had upstream pressure pulses; (6) The overall average speed (390 km/s) of the best 28 events is less than the normally quoted for the average solar wind speed (420 km/s) The average of central cloud speed to the upstream solar wind speed was not much greater than one (1.08), even though many of these clouds were drivers of interplanetary shocks. Cloud expansion is partly the reason for the existence of upstream shocks; (7) The cloud axes often (about 50 % of the time) revealed reasonable attitudes with respect to the interpreted solar source, from simple geometry, but many bore no relationship, suggesting that their observations at 1 AU were probably those of the legs of the global cloud often having near-radial axes; (8) many clouds appear to have magnetic holes at or their their boundaries.
Author
Force-Free Magnetic Fields; Magnetic Clouds; Polarity; Solar Wind; Magnetic Field Configurations; Interplanetary Magnetic Fields; Solar Planetary Interactions; Solar Wind Velocity

NASA Goddard Space Flight Center, Greenbelt, MD USA
The Guara Campaign: Rocket-Radar Investigations of the Earth's Upper Atmosphere at the Magnetic and Geographic Equators
Pfaff, Robert F., Jr., NASA Goddard Space Flight Center, USA; Goldberg, Richard A., NASA Goddard Space Flight Center, USA; Schmidlin, F. J., NASA Goddard Space Flight Center, USA; Sobral, J. H. A., Instituto Nacional de Pesquisas Espacias, Brazil; Abdu, M., Instituto Nacional de Pesquisas Espacias, Brazil; Trivedi, N., Instituto Nacional de Pesquisas Espacias, Brazil; Swartz, W. E., Cornell Univ., USA; LaBelle, J. W., Dartmouth Coll., USA; Larsen, M. F., Clemson Univ., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Guara Campaign consisted of a series of sounding rockets that were launched from August to October, 1994 at a new launch facility at Alcantara, Brazil, which is within one degree of the Earth's magnetic equator. The campaign was based on focused scientific experiments designed to investigate the electrodynamics and irregularities in the ionosphere and mesosphere at the Earth's magnetic equator and to study their relationship with neutral upper atmosphere motions. In all, 13 large sounding rockets and 20 small meteorological rockets were launched as part of four different experiment groups designed to investigate: (1) the daytime equatorial electrojet, (2) very high altitude Spread-F processes, (3) sunset electrodynamics, and (4) middle atmosphere-thermosphere coupling at the equator. The instrumentation on the sounding rockets varied with each investigation, but primarily included experiments to measure electric fields, currents, plasma densities,- neutral winds, neutral densities and temperatures, and ionospheric instabilities. All of the experiments utilized ground-based scientific instruments including a VHF backscatter radar interferometer, magnetometers, ionosondes, and scintillation receivers. An overview of each investigation is provided, along with a description of the launch site and the ground-based experiments. Scientific highlights of the campaign are provided.
Author
Equatorial Electrojet; Equators; Mesosphere; Thermosphere; Spread F; High Altitude; Electrodynamics; Sunset; Middle Atmosphere

Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
Determination of MUF During Geomagnetic Disturbances *Penentuan MUF Pada Saat Terjadi Gangguan Geomagnet*
Mumen, T., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; M. Sjarifudin, Lembaga Penerbangan dan Antariksa

For determining Maximum Usable Frequency (MUF) during geomagnetic disturbance events by using Katz method, it is necessary to apply both foF2 data, during quiet and disturbed conditions. For analysing MUF during geomagnetic events, it is used foF2 and geomagnetic indeks K observed at station of aerospace observation of Biak (01 deg 08 min 39 sec S; 136 deg 02 min 46 sec E). The result was that the stronger geomagnetic disturbance was not necessarily followed by increasing MUF(sub D) - MUF(sub Q) deviation. This confirmed the result of Thompson (1988).

Author

Maximum Usable Frequency; Geomagnetism; Magnetic Disturbances

19990102917 Los Alamos National Lab., NM USA

Anisotropic multi-resolution analysis in 2D, application to long-range correlations in cloud mm-radar fields

Davis, A. B.; Clothiaux, E.; Dec. 31, 1999; 13p; In English

Report No.(s): DE99-001997; LA-UR-99-282; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Because of Earth's gravitational field, its atmosphere is strongly anisotropic with respect to the vertical; the effect of the Earth's rotation on synoptic wind patterns also causes a more subtle form of anisotropy in the horizontal plane. The authors survey various approaches to statistically robust anisotropy from a wavelet perspective and present a new one adapted to strongly non-isotropic fields that are sampled on a rectangular grid with a large aspect ratio. This novel technique uses an anisotropic version of Multi-Resolution Analysis (MRA) in image analysis; the authors form a tensor product of the standard dyadic Haar basis, where the dividing ratio is (lambda)(sub z) = 2, and a nonstandard triadic counterpart, where the dividing ratio is (lambda)(sub x) = 3. The natural support of the field is therefore 2(sup n) pixels (vertically) by 3(sup n) pixels (horizontally) where n is the number of levels in the MRA. The natural triadic basis includes the French top-hat wavelet which resonates with bumps in the field whereas the Haar wavelet responds to ramps or steps. The complete 2D basis has one scaling function and five wavelets. The resulting anisotropic MRA is designed for application to the liquid water content (LWC) field in boundary-layer clouds, as the prevailing wind advects them by a vertically pointing mm-radar system. Spatial correlations are notoriously long-range in cloud structure and the authors use the wavelet coefficients from the new MRA to characterize these correlations in a multifractal analysis scheme. In the present study, the MRA is used in realistically although only a few parameters are used to control the randomness of the LWC's wavelet coefficients.

NTIS

Anisotropy; Correlation; Cloud Physics; Cloud Cover

19990102919 Max-Planck-Inst. fuer Chemie, Biogeochemistry Dept., Mainz, Germany

Interrelationships Between Aerosol Characteristics and Light Scattering During Late-winter in a Eastern Mediterranean Arid Environment

Ichoku, C., Max-Planck-Inst. fuer Chemie, Germany; Andreae, M. O., Max-Planck-Inst. fuer Chemie, Germany; Meixner, F. X., Max-Planck-Inst. fuer Chemie, Germany; Schebeske, G., Max-Planck-Inst. fuer Chemie, Germany; Formenti, P., Max-Planck-Inst. fuer Chemie, Germany; Maenhaut, W., Institute for Nuclear Sciences, Belgium; Cafmeyer, J., Institute for Nuclear Sciences, Belgium; Ptasinski, J., Institute for Nuclear Sciences, Belgium; Karnieli, A., Ben Gurion Univ. of the Negev, Israel; Orlovsky, L., Ben Gurion Univ. of the Negev, Israel; [1999]; 67p; In English; Sponsored inpart by the Max-Planck Society, Germany; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

An intensive field campaign involving measurement of various aerosol physical, chemical, and radiative properties was conducted at Sde Boker in the Negev Desert of Israel, from 18 February to 15 March 1997. Nephelometer measurements gave average background scattering coefficient values of about 25 M/m at 550 nm wavelength, but strong dust events caused the value of this parameter to rise up to about 800 M/m Backscattering fractions did not depend on aerosol loading, and generally fell in the range of 0.1 to 0.25, comparable to values reported for marine and Arctic environments. Chemical analysis of the aerosol revealed that, in the coarse size range (2 - 10 micrometer equivalent aerodynamic diameter (EAD)), calcium (CA) was by far the most abundant element followed by silicon (Si), both of which are indicators for mineral dust. In the fine size fraction (is less than 2 micrometers EAD), sulfur (S) generally was the dominant element, except during high dust episodes when Ca and Si were again the most abundant. Furthermore, fine black carbon (BC) correlates with S, suggesting that they may have originated from the same sources or source regions. An indication of the short-term effect of aerosol loading on radiative forcing was provided by measurements of global and diffuse solar radiation, which showed that during high turbidity periods (strong dust events) almost all of the solar radiation reaching the area is scattered or absorbed.

Author

Aerosols; Dust; Arid Lands; Backscattering; Light Scattering; Scattering Coefficients; Diffuse Radiation; Solar Radiation

Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Sporadic E-Layer Shift Above Sumedang *Pergeseran Lapisan E Sporadis Di Atas Sumedang*

Suhartini, Sri, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July 1998; ISSN 0126-0480; Volume 22, No. 86, pp. 8-13; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

E sporadic drift influence the reflection mechanism of the High Frequency (HF) signal in ionosphere, caused fading on radio communication. Drift velocity of the sporadic E layer over Sumedang (6.5 deg S, 107.47 deg E) studied by using the Doppler shift data from digital ionosonda IPS-71 on January 1995. The result was: vertical drift velocity calculated for several frequencies has a value between 0 to 50 km/h and horizontal drift velocity 2.5 to 200 km/h.
Author

Sporadic E Layer; Phase Shift

Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Effects of Lower-Atmosphere Temperatures on Ionosphere Minimum Frequencies *Pengaruh Temperatur Atmosfer Bawah Terhadap Frekuensi Minimum Ionosfer*

Mumen, T., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Buldan, M., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; M. Sjarifuddin, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July 1998; ISSN 0126-0480; Volume 22, No. 86, pp. 14-18; In Malay-Indonesian; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Ionospheric layer (upper atmosphere) has an important role as reflection of high frequency because it contains charged particle. Warming of neutral particle in lower atmosphere can change distribution of charged particle in the ionosphere that produces variation of minimum frequency of ionospheric layer (fmin). It is found that variation of fmin 0.08 MHz for 1 deg variation of temperature with coefficient of cross correlation between T 30 mb and fmin +0.67 for delay time of 3 days. Delay time of 3 days may be produced by interaction between lower atmosphere and ionosphere that is manifested in planetary wave with dominant period of 3 days.
Author

Lower Atmosphere; Atmospheric Temperature; Upper Atmosphere; Frequencies; Atmospheric Effects

Communications Research Lab., Ministry of Posts and Telecommunications, Kashima, Japan

Research of Neutral Winds in the Polar Lower Thermosphere Using Radar Techniques

Kunitake, Manabu, Communications Research Lab., Japan; Journal of the Communications Research Laboratory; Nov. 1993; ISSN 0914-9260; Volume 40, No. 3, pp. 141-151; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Radar techniques are proved useful in the researching neutral winds (the motion of the neutral atmosphere) in the lower thermosphere (80-150 km in altitude) in the polar region. Their usefulness is also confirmed for the research of dynamical coupling of the lower thermosphere with the magnetosphere through electrodynamics and with the mesosphere through aerodynamics. Statistical analyses of neutral wind variations with EISCAT (European Incoherent Scatter Radar) data are briefly introduced. Then, the research of neutral winds by CRL using a coherent 50-MHz Doppler radar system at Syowa Station in Antarctica are reviewed and its prospects for the future are discussed. Keywords: neutral wind, lower thermosphere, IS radar, meteor radar, magnetospheric effect
Author

Research; Wind Variations; Winds Aloft; Eiscat Radar System (Europe); Statistical Analysis; Neutral Atmospheres

NASA Marshall Space Flight Center, Huntsville, AL USA

Observations of Substorms from the Auroral Ionosphere to the Distant Plasma Sheet

Parks, G., Washington Univ., USA; Brittnacher, M., Washington Univ., USA; Chen, L., Washington Univ., USA; Chua, D., Washington Univ., USA; Elsen, R., Washington Univ., USA; Fillingim, M., Washington Univ., USA; McCarthy, M., Washington Univ., USA; Germany, G., Alabama Univ., USA; Spann, J., NASA Marshall Space Flight Center, USA; [1998]; In English; 4th Substorms, 9-13 Mar. 1998, Lake Hamana4th, Japan; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

We have been studying how substorms work by examining the global polar Ultraviolet Imager (UVI) images in correlation with observations from the ground, interplanetary space and the geomagnetic tail between 10-20 earth radii. One of the objectives of our study is to better understand the connection among many complex phenomena going on close to Earth and those in the distant plasma sheet. We have studied, for example, how the aurora[and polar cap boundaries at different local times behave in relation to variations observed in the solar wind and plasma sheet during substorms. Preliminary results indicate that the polar cap and auroral oval boundaries expand and contract in a complicated but systematic way. These variations are correlated to solar

wind parameters, and thinning and recovery phenomena in the plasma sheet. These results will be presented and interpreted in terms of directly driven and/or unloading substorm processes.

Author

Auroras; Magnetic Storms; Plasma Interactions; Polar Caps; Solar Wind; Ionospheric Storms; Earth Ionosphere

19990103057 Federal Energy Technology Center, Morgantown, WV USA

Size Scaling Relationships in Fracture Networks

Wilson, T., Federal Energy Technology Center, USA; Jul. 27, 1998; 93p; In English

Report No.(s): DE00-007168; DE-FG26-98FT40385-01; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Work focused on the program development phase, which has been successfully completed. A revised timetable has been prepared that reflects the June start date and other modifications associated with internal budgeting problems and the actual versus proposed start dates.

NTIS

Scaling Laws; Fracturing; Geological Faults

19990103108 NASA Goddard Space Flight Center, Greenbelt, MD USA

Short-Term Uplift Rates and the Mountain Building Process in Southern Alaska

Sauber, Jeanne, NASA Goddard Space Flight Center, USA; Herring, Thomas A., Massachusetts Inst. of Tech., USA; Meigs, Andrew, NASA Goddard Space Flight Center, USA; Meigs, Andrew, Oregon State Univ., USA; [1998]; 1p; In English, 6-10 Dec. 1998, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA

Contract(s)/Grant(s): NASA Order S-95247-Z; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We have used GPS at 10 stations in southern Alaska with three epochs of measurements to estimate short-term uplift rates. A number of great earthquakes as well as recent large earthquakes characterize the seismicity of the region this century. to reliably estimate uplift rates from GPS data, numerical models that included both the slip distribution in recent large earthquakes and the general slab geometry were constructed.

Author

Earthquakes; Seismology

19990103130 NASA Goddard Space Flight Center, Greenbelt, MD USA

Thermal Sensitivity of MD Hematite: Implication for Magnetic Anomalies

Kletetschka, Gunther, NASA Goddard Space Flight Center, USA; Wasilewski, Peter J., NASA Goddard Space Flight Center, USA; Taylor, Patrick T., NASA Goddard Space Flight Center, USA; [1999]; 11p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Magnetic remanence of crustal rocks can reside in three common rock-forming magnetic minerals: magnetite, pyrrhotite, and hematite. Thermoremanent magnetization (TRM) of magnetite and pyrrhotite is carried mostly by single domain (SD) grains. The TRM of hematite grains, however, is carried mostly by multidomain (NM) grains. This characteristic is illustrated by TRM acquisition curves for hematite of variable grainsizes. The transition between truly NM behavior and tendency towards SD behavior his been established between hematite grainsizes of 0. 1 and 0.05 mm. Coarse grainsize of lower crustal rocks and the large sensitivity of MD hematite grains to acquire TRM indicates that hematite could be a significant contributor to long-wavelength magnetic anomalies.

Author

Thermal Conductivity; Magnetic Anomalies; Sensitivity; Hematite

19990103143 NASA Marshall Space Flight Center, Huntsville, AL USA

A Satellite-Derived Upper-Tropospheric Water Vapor Transport Index for Climate Studies

Jedlovec, Gary J., NASA Marshall Space Flight Center, USA; Lerner, Jeffrey A., Alabama Univ., USA; Atkinson, Robert J., Lockheed Martin Corp., USA; July 1998; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A new approach is presented to quantify upper-level moisture transport from geostationary satellite data. Daily time sequences of GOES-7 water vapor imagery were used to produce estimates of winds and water vapor mixing ratio in the upper-troposphere sensed by the 6.7-microns water vapor channel. The winds and mixing ratio values were gridded and then combined to produce a parameter called the Water Vapor Transport Index (WVTI) which represents the magnitude of the two dimensional transport of water vapor in the upper troposphere. Daily grids of WVTI, meridional moisture transport, mixing ratio, pressure and other associated parameters were averaged to produce monthly fields for June, July and August of 1987 and 1988 over the Ameri-

cas and surrounding oceanic regions. The WVTI was used to compare upper-tropospheric moisture transport between the summers of 1987 and 1988, contrasting the latter part of the 1986/87 El Nino event and the La Nina period of 1988. A similar product derived from the NCEP reanalysis was used to help validate the index and understand interannual variability of moisture transport from the modeling perspective. Both datasets showed large upper-level water vapor transport associated with synoptic features over the Americas and with outflow from tropical convective systems. Minimal transport occurred over tropical and subtropical high pressure regions where winds were light. Index values from NCEP were 2-3 times larger than that determined from the GOES satellite This difference resulted from an over estimate of the zonal winds and upper-tropospheric moisture in the reanalysis model. A comparison of the satellite-derived monthly values between the summers of 1987 and 1988 provided some insight into the impact of the ENSO event on upper-level moisture and its transport during the period. During July 1987, a large portion of the tropics in the eastern Pacific Ocean and Caribbean Sea was dominated by strong vapor transport in excess of 5 g/kg/ms with relatively small amounts in the other months. In contrast, JJA 1988 showed an opposite trend with July 1988 being less dominated by tropical water vapor transport. The meridional transport of upper-level water vapor indicated significant poleward transport from the tropics to the higher latitudes. This transport favored the Southern Hemisphere with large transport occurring south of the ITCZ which extended across the eastern Pacific and northern South America. Zonally-averaged monthly transport values were shown to provide a simple way to quantify the monthly and interannual changes in water vapor transport. Zonally-averaged WVTI values peaked in the Southern Hemisphere subtropics during both Austral winters. In the tropics a single more pronounced peak located over the equator and south latitudes occurred in 1988 as opposed to a dual peak in 1987. The second peak around 20 deg.N latitude is consistent with findings of others where upper-tropospheric winds were noted to be stronger in this region during warm ENSO events. Zonally-averaged meridional transport was southward for all summer months and stronger in 1988. The asymmetric nature of the zonally-averaged meridional transport (more southerly water vapor transport) was enhanced during JJA 1998 thus indicating a stronger upper-level branch of the Hadley circulation during this notable strong La Nina period.
Author

Climatology; Convection; Satellite Imagery; Mixing Ratios; Satellite Observation; Atmospheric Moisture; Transport Properties; Synchronous Platforms

19990103149 NASA Marshall Space Flight Center, Huntsville, AL USA

Observations of Ion Signatures of Magnetic Reconnection for Northward IMF

Chandler, Michael O., NASA Marshall Space Flight Center, USA; Moore, Thomas E., NASA Marshall Space Flight Center, USA; Fuselier, S., NASA Marshall Space Flight Center, USA; Lockwood, Michael, NASA Marshall Space Flight Center, USA; October 1998; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Magnetic merging at Earth's magnetopause produces distinct mixtures of ions and electrons as well as signatures in their distribution functions. High resolution measurements allow for the separation of the different distributions and quantification of their characteristics. This provides details on the temporal and spatial nature of the merging site and the resulting history of the merged fields. The event of May 29, 1996 resulted in remote observations of the effects of reconnection on both magnetosheath and magnetosphere populations for a period of approximately three hours. Three-dimensional ion distributions obtained by the Thermal Ion Dynamics Experiment on the Polar spacecraft show that field lines threading the spacecraft's location in the northern cusp region contained a mix of D-shaped ions from the magnetosheath and accelerated magnetospheric ions both moving parallel to the local magnetic field. This mix of ions resulted from transmission of magnetosheath ions across the magnetopause at speeds greater than the de-Hoffman-Teller speed and the reflection of cold, slow-moving plasmasphere-like ions at the magnetopause. These observations are used to conclude that these field lines were connected to the ionosphere in the northern hemisphere and, southward of the spacecraft, the interplanetary magnetic field and crossed the magnetopause in the equatorial region southward of the spacecraft.
Author

Ion Distribution; Observation; Magnetic Field Reconnection; Earth Magnetosphere; Magnetosheath; Electrons

19990103161 NASA Marshall Space Flight Center, Huntsville, AL USA

Survey of Warm Pancake-Shaped Ion Distributions at Geosynchronous Orbit

Ober, Daniel M., NASA Marshall Space Flight Center, USA; Thomsen, M. F., Los Alamos National Lab., USA; Gallagher, D. L., NASA Marshall Space Flight Center, USA; Gary, S. P., Los Alamos National Lab., USA; McComas, D. J., Los Alamos National Lab., USA; 1998; 1p; In English, 26-29 May 1998, Boston, MA, USA; Sponsored by American Geophysical Union; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

It has been proposed that the electromagnetic proton cyclotron instability is the strongest source of heating for the anisotropic warm ions observed at geosynchronous orbit. We present here the results of a statistical study of warm pancake-shaped ion distributions observed with the Los Alamos magnetospheric plasma analyzer (MPA) on geosynchronous satellites. We examined the

ion distributions to determine the correlation between the observed warm ion distributions and various magnetospheric parameters, and their location relative to the plasma trough, plasmasphere, plasma sheet, and local time. We find that the warm pancake-shaped ion distributions occur more frequently near noon, and during low magnetospheric activity. The implications of our observations for the proton cyclotron instability, as the source of energy for the warm ions, will be discussed.
Author

Ion Distribution; Observation; Geosynchronous Orbits; Statistical Analysis; Magnetohydrodynamic Stability; Heating

19990103168 NASA Marshall Space Flight Center, Huntsville, AL USA

Magnetospheric Response to the Arrival of the Shock Wave in Front of the Magnetic Cloud of January 10, 1997

Wuest, M., Southwest Research Inst., USA; Huddleston, M. M., Southwest Research Inst., USA; Burch, J. L., Southwest Research Inst., USA; Dempsey, D. L., Southwest Research Inst., USA; Craven, P. D., NASA Marshall Space Flight Center, USA; Chandler, M. O., NASA Marshall Space Flight Center, USA; Spann, J. F., NASA Marshall Space Flight Center, USA; Peterson, W. K., Lockheed Martin Corp., USA; Collin, H. L., Lockheed Martin Corp., USA; Lennartsson, W., Lockheed Martin Corp., USA; [1999]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We are Studying the magnetic cloud event of January 6 - 11, 1997. Specifically, we have investigated the response of the magnetosphere to the shock wave in front of the magnetic cloud on January 10, 1997 using data from WIND, GEOTAIL and POLAR spacecraft as well as ground magnetometer data. The WIND spacecraft, which was located as about 104 Re upstream from the Earth (85.1, -55.2, -22.1) Re(sub GSM), observed the arrival of the shock wave front at 0050 UT. Geotail was located at the equatorial magnetopause (approx. 8.7 Re, 10.7 MLT, -7.46 MLAT), while POLAR was located in the northern dawn sector above the auroral zone at 8.4 Re, 6.1 MLT and 61.1 MLAT. A magnetic signature was nearly simultaneously observed at about 0104 UT at the POLAR and Geotail spacecraft. The Geotail spacecraft entered from the magnetosphere into the magnetosheath. Particle density increases were observed on WIND and Geotail, but not on POLAR. Two instruments on the Polar spacecraft (TIDE and TIMAS) actually observed a slight reduction in energy, density and temperature. The UV aurora shows a dawnside intensification. The shock wave did not cause an auroral substorm and therefore was not geoeffective.
Author

Magnetospheres; Shock Waves; Ground Tests; Research; Magnetic Clouds; Data Acquisition

19990103172 NASA Marshall Space Flight Center, Huntsville, AL USA

Impact of Model Uncertainties on Quantitative Analysis of FUV Auroral Images: Peak Production Height

Germany, G. A., NASA Marshall Space Flight Center, USA; Lummerzheim, D., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Spann, James F., Jr., NASA Marshall Space Flight Center, USA; Richards, Phil G., NASA Marshall Space Flight Center, USA; [1000]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We demonstrate that small uncertainties in the modeled height of peak production for FUV emissions can lead to significant uncertainties in the analysis of these sai-ne emissions. In particular, an uncertainty of only 3 km in the peak production height can lead to a 50% uncertainty in the mean auroral energy deduced from the images. This altitude uncertainty is comparable to differences in different auroral deposition models currently used for UVI analysis. Consequently, great care must be taken in quantitative photometric analysis and interpretation of FUV auroral images.
Author

Production; Models; Quantitative Analysis

19990103360 NASA Goddard Space Flight Center, Greenbelt, MD USA

Statistical Perspectives on Stratospheric Transport

Sparling, L. C., NASA Goddard Space Flight Center, USA; [1999]; 74p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Long-lived tropospheric source gases, such as nitrous oxide, enter the stratosphere through the tropical tropopause, are transported throughout the stratosphere by the Brewer-Dobson circulation, and are photochemically destroyed in the upper stratosphere. These chemical constituents, or "tracers" can be used to track mixing and transport by the stratospheric winds. Much of our understanding about the stratospheric circulation is based on large scale gradients and other spatial features in tracer fields constructed from satellite measurements. The point of view presented in this paper is different, but complementary, in that transport is described in terms of tracer probability distribution functions (PDFs). The PDF is computed from the measurements, and is proportional to the area occupied by tracer values in a given range. The flavor of this paper is tutorial, and the ideas are illustrated with several examples of transport-related phenomena, annotated with remarks that summarize the main point or suggest new directions. One example shows how the multimodal shape of the PDF gives information about the different branches of the circula-

tion. Another example shows how the statistics of fluctuations from the most probable tracer value give insight into mixing between different regions of the atmosphere. Also included is an analysis of the time-dependence of the PDF during the onset and decline of the winter circulation, and a study of how "bursts" in the circulation are reflected in transient periods of rapid evolution of the PDF. The dependence of the statistics on location and time are also shown to be important for practical problems related to statistical robustness and satellite sampling. The examples illustrate how physically-based statistical analysis can shed some light on aspects of stratospheric transport that may not be obvious or quantifiable with other types of analyses. An important motivation for the work presented here is the need for synthesis of the large and growing database of observations of the atmosphere and the vast quantities of output generated by atmospheric models.
Author
Probability Distribution Functions; Stratosphere; Transport Properties; Atmospheric Circulation; Atmospheric Composition; Atmospheric Models; Chemical Composition; Photochemical Reactions

19990103609 NASA Goddard Inst. for Space Studies, New York, NY USA
Aerosol Retrievals Using Channel 1 and 2 AVHRR Data
Mishchenko, Michael I., NASA Goddard Inst. for Space Studies, USA; Geogdzhayev, Igor V., NASA Goddard Inst. for Space Studies, USA; Cairns, Brian, NASA Goddard Inst. for Space Studies, USA; Rossow, William B., NASA Goddard Inst. for Space Studies, USA; 1999; 4p; In English; Atmospheric Radiation, Unknown; Sponsored by American Meteorological Society, USA; Original contains color illustrations
Report No.(s): GCN-99-36; Copyright; Avail: Issuing Activity, Hardcopy
     The effect of tropospheric aerosols on global climate via the direct and indirect radiative forcings is one of the largest remaining uncertainties in climate change studies. Current assessments of the direct aerosol radiative effect mainly focus on sulfate aerosols. It has become clear, however, that other aerosol types like soil dust and smoke from biomass burning are also likely to be important climate forcing factors. The magnitude and even the sign of the climate forcing caused by these aerosol types is still unknown. General circulation models (GCMs) can be used to estimate the climatic effect of the direct radiative forcing by tropospheric and stratospheric aerosols. Aerosol optical properties are already parameterized in the Goddard Institute for Space Studies GCM. Once the global distribution of aerosol properties (optical thickness, size distribution, and chemical composition) is available, the calculation of the direct aerosol forcing is rather straighfforward. However, estimates of the indirect aerosol effect require additional knowledge of the physics and chemistry of aerosol-cloud interactions which are still poorly understood. One of the main objectives of the Global Aerosol Climatology Project, established in 1998 as a joint initiative of NASA's Radiation Science Program and GEWEX, is to infer the global distribution of aerosols, their properties, and their seasonal and interannual variations for the full period of available satellite data. This will be accomplished primarily through a systematic application of multichannel aerosol retrieval algorithms to existing satellite data and advanced 3-dimensional aerosol chemistry/transport models. In this paper we outline the methodology of analyzing channel 1 and 2 AVHRR radiance data over the oceans and describe preliminary retrieval results.
Author
Aerosols; Annual Variations; Atmospheric General Circulation Models; Climate Change; Climatology

19990103945 NASA Marshall Space Flight Center, Huntsville, AL USA
Far Ultraviolet Imaging from the Image Spacecraft, 1, System Design
Mende, S. B., NASA Marshall Space Flight Center, USA; Heetderks, H., NASA Marshall Space Flight Center, USA; Frey, H. U., NASA Marshall Space Flight Center, USA; Lampton, M., NASA Marshall Space Flight Center, USA; Geller, S. P., NASA Marshall Space Flight Center, USA; Habraken, S., NASA Marshall Space Flight Center, USA; Renotte, E., NASA Marshall Space Flight Center, USA; Jamar, C., NASA Marshall Space Flight Center, USA; Rochus, P., NASA Marshall Space Flight Center, USA; Spann, J., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
     Direct imaging of the magnetosphere by the IMAGE spacecraft A,ill be supplemented by observation of the global aurora, the footprint of magnetospheric regions. to assure the simultaneity of these observations and tile measurement of the magnetospheric back-round neutral gas density, the IMAGE satellite instrument complement includes three Far Ultraviolet (FUV) instruments. In tile wavelength region 120-1 90 nm. a downward-viewing aurora imager is only minimally contaminated sunlight, scattered from clouds and ground, and radiance of the aurora observed in a nadir viewing geometry can be observed in the presence of the high-latitude day-low. Tile Wideband Imaging Camera (WIC) will provide broadband ultraviolet images of the aurora for maximum spatial and temporal resolution by imaging the LBH N2 bands of the aurora. The Spectrographic Imager (SI), a monochromatic imager, will image different types of aurora, filtered by wavelength. by measuring the Doppler-shifted Lyman-alpha, the proton-induced component of the aurora will be imaged separately. Finally, the GEO instrument will observe the distribution

of the geocoronal emission, which is a measure of the neutral background density source of the charge exchange in the magneto-sphere. The FUV instrument complement looks radially outward from the rotating IMAGE satellite and, therefore, it spends only a short time observing tile aurora and the Earth during, each spin. Detailed descriptions of the WIC, Si, GEO, and their individual performance validations are discussed in companion papers. This paper summarizes the system requirements and system design approach taken to satisfy the science requirements. One primary requirement is to maximize photon collection efficiency and use efficiently tile short time available foe exposures. The FUV auroral imagers WIC and SI both have wide fields of view and take data continuously as the auroral region proceeds through the field of view. to minimize data volume, multiple images are taken and electronically co-added by suitably shifting each image to compensate for the spacecraft rotation. In order to minimize resolution loss, the images have to be distortion-corrected in real time foe both WIC and Si prior to co-adding. The distortion correction is accomplished using high-speed look Lip tables that are pre-generated by least square fitting to polynomial functions by the on-orbit processor. The instruments were calibrated individually while on stationary platforms, mostly in vacuum chambers as described in the companion papers. Extensive -round-based testing was performed with visible and near UV simulators mounted oil a rotating platform to estimate their on-orbit performance. The predicted instrument system performance is summarized and some of the preliminary data formats are shown.
Author
Ultraviolet Imagery; Systems Engineering; Design Analysis; Far Ultraviolet Radiation; Geocoronal Emissions; Planetary Magnetospheres

19990103946 NASA Marshall Space Flight Center, Huntsville, AL USA
An ET Origin for Stratospheric Particles Collected during the 1998 Leonids Meteor Shower
Noever, David A., NASA Marshall Space Flight Center, USA; Phillips, James A., Bishop WebWorks, USA; Horack, John M., NASA Marshall Space Flight Center, USA; Jerman, Gregory, NASA Marshall Space Flight Center, USA; Myszka, Ed, CSC Corp., USA; 1999; 2p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
On 17 November 1998, a helium-filled weather balloon was launched into tfle strato- sphere, equipped with a xerogel micro-particle collector. The three-hour flight was designed to sample the dust environment in the stratosphere during the Leonid meteor shower, and possibly to capture Leonid meteoroids. Environmental Scanning Election Microscope analyses of the returned collectors revealed the capture of a -30-pm particle. with a smooth, multigranular shape, and partially melted, translucent rims; similar to known Antarctic micrometeorites. Energy-dispersive X-ray Mass Spectroscopy shows en- riched concentrations of the nonvolatile elements, Mg, Al, and Fe. The particle possesses a high magnesium to iron ratio of 2.96, similar to that observed in 1998 Leonids meteors (Borovicka, et al. 1999) and sharply higher than the ratio expected for typical material from the earth's crust. A statistical nearest-neighbor analysis of the abundance ratios Mg/Si, Al/Si, and Fe/Si demonstrates that the particle is most similar in composition to cosmic spherules captured during airplane flights throucrh the stratosphere. The mineralogical class is consistent with a stony (S) type of silicates. olivine [(Mg, Fe)2SiO4] and pyroxene [(Mg,Fe)SiO3]-or oxides, herecynite [(Fe,Mg)Al2O4]. Attribution to the debris stream of the Leonids' parent body, comet Tempel-Tuttle, would make it the first such material from beyond the orbit of Uranus positively identified on Earth.
Author
Earth Crust; Stratosphere; Accumulators; Leonid Meteoroids; X Ray Spectroscopy

19990103956 NASA Goddard Space Flight Center, Greenbelt, MD USA
Trajectory Simulations of Upper Tropospheric Humidity
Dessler, A. E., NASA Goddard Space Flight Center, USA; Schoeberl, M. R., NASA Goddard Space Flight Center, USA; Sherwood, S. C., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
We present comparisons of simulations of upper tropospheric humidity at 215 and 146 hPa with satellite measurements. Our model uses diabatic trajectories to advect water vapor from an initial condition of 100% relative humidity to the final state. The model does not allow parcels' relative humidity to exceed 100%, and in this way crudely incorporates condensation. We find that this simple model does a good job of simulating the observations. Sensitivity studies suggest that one must have realistic wind velocities in order to accurately simulate the humidity distribution; microphysical parameterizations seem to be less important. Comparisions between simulations using UKMO and NCEP horizontal winds will be discussed.
Author
Humidity; Trajectories; Troposphere; Water Vapor; Meteorological Parameters

A New NASA Data Product: Tropospheric and Stratospheric Column Ozone in the Tropics Derived from TOMS Measurements

Ziemke, J. R., NASA Goddard Space Flight Center, USA; Chandra, S., NASA Goddard Space Flight Center, USA; Bhartia, P. K., NASA Goddard Space Flight Center, USA; [1999]; 13p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tropospheric column ozone (TCO) and stratospheric column ozone (SCO) gridded data in the tropics for 1979-present are now available from NASA Goddard Space Flight Center via either direct ftp, world-NN,ide-NN,eb, or electronic mail. This note provides a brief overview of the method used to derive the data set including validation and adjustments.
Author

Ozone; Stratosphere; Data Acquisition; Tropical Regions

Mass Spectrometric Identification of Si-O-H(g) Species from the Reaction of Silica with Water Vapor at Atmospheric Pressure

Opila, Elizabeth J., Cleveland State Univ., USA; Fox, Dennis S., NASA Lewis Research Center, USA; Jacobson, Nathan S., NASA Lewis Research Center, USA; Journal of the American Ceramic Society; 1997; Volume 80, No. 4, pp. 1009-1012; In English

A high-pressure sampling mass spectrometer was used to detect the volatile species formed from SiO_2 at temperatures between 1200C and 1400C in a flowing water vapor/oxygen gas mixture at 1 bar total pressure. The primary vapor species identified was $Si(OH)_4$. The fragment ion $Si(OH)_3+,$' was observed in quantities 3 to 5 times larger than the parent ion $Si(OH)_4+$. The $Si(OH)_3+$ intensity was found to have a small temperature dependence and to increase with the water vapor partial pressure as expected. In addition, $SiO(OH)+$ believed to be a fragment of $SiO(OH)_2$, was observed. These mass spectral results were compared to the behavior of silicon halides.
Author

Oxygen; Silicon; Silicon Dioxide; Mass Spectrometers; Hydrogen; Water Vapor; Gas Mixtures; High Temperature; Volatility

Global Auroral Energy Deposition during Substorm Onset Compared with Local Time and Solar Wind IMF Conditions

Spann, J. F., NASA Marshall Space Flight Center, USA; Brittnacher, M., NASA Marshall Space Flight Center, USA; Fillingim, M. O., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Physics of Space Plasmas, 20 Jun. - 5 Jul. 1998, Lisbon, Portugal; No Copyright; Avail: Issuing Activity (NASA, Marshall Space Flight Center, Huntsville, AL); Abstract Only, Hardcopy, Microfiche

The global images made by the Ultraviolet Imager (UVI) aboard the IASTP/Polar Satellite are used to derive the global auroral energy deposited in the ionosphere resulting from electron precipitation. During a substorm onset, the energy deposited and its location in local time are compared to the solar wind IMF conditions. Previously, insitu measurements of low orbiting satellites have made precipitating particle measurements along the spacecraft track and global images of the auroral zone, without the ability to quantify energy parameters, have been available. However, usage of the high temporal, spatial, and spectral resolution of consecutive UVI images enables quantitative measurement of the energy deposited in the ionosphere not previously available on a global scale. Data over an extended period beginning in January 1997 will be presented.
Author

Satellites; Satellite Imagery; Energy Transfer; Auroral Zones; Solar Wind; Magnetic Storms

University of Denver Infrared Spectral Atlases

Goldman, A., Denver Univ., USA; Blatherwick, R. D., Denver Univ., USA; Murcray, F. J., Denver Univ., USA; Murcray, D. G., Denver Univ., USA; Applied Optics; Jun. 01, 1996; ISSN 0003-6935; Volume 35, No. 16, pp. 2821-2827; In English; Copyright; Avail: Issuing Activity, Hardcopy

Atmospheric and laboratory atlases of high-resolution infrared absorption spectra have been generated from data obtained with the University of Denver Michelson-type interferometer balloon-borne spectrometer systems. The main objectives of the atlas work have been the-identification and the detailed analysis of stratospheric infrared high-resolution spectral features. The stratospheric atlases cover many spectral intervals and provide tables of line positions and species identifications. High Sun spec-

tra are used for identification of solar lines. Latest editions of these atlases include selected sections in the 760-1950- and 800-1700/cm regions at 0.02- and 0.002/cm resolutions. respectively. In addition to the stratospheric atlases, ground-based and laboratory spectral atlases have also been produced. The laboratory spectra of many molecules relevant to stratospheric chemistry have been obtained. A number of ongoing spectroscopic studies have been developed on the basis of the atlas work, including studies of solar and atmospheric spectral features. 1996 Optical Society of America.
Author

Infrared Spectra; Atmospheric Chemistry; Infrared Radiation; Absorption Spectra; Data Acquisition

19990104373 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Onset of Magnetic Reconnection in Tail-Like Equilibria

Hesse, Michael, NASA Goddard Space Flight Center, USA; Birn, Joachim, Los Alamos National Lab., USA; Kuznetsova, Masha, Raytheon STX Corp., USA; 1999; 1p; In English, 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Magnetic reconnection is a fundamental mode of dynamics in the magnetotail, and is recognized as the basic mechanisms converting stored magnetic energy into kinetic energy of plasma particles. The effects of the reconnection process are well documented by spacecraft observations of plasmoids in the distant magnetotail, or bursty bulk flows, and magnetic field dipolarizations in the near Earth region. Theoretical and numerical analyses have, in recent years, shed new light on the way reconnection operates, and, in particular, which microscopic mechanism supports the dissipative electric field in the associated diffusion region. Despite this progress, however. the question of how magnetic reconnection initiates in a tail-like magnetic field with finite flux threading the current i.sheet remains unanswered. Instead, theoretical studies supported by numerical simulations support the point-of-view that such plasma and current sheets are stable with respect to collisionless tearing mode. In this paper, we will further investigate this conclusion, with emphasis on the question whether it remains valid in plasma sheets with embedded thin current sheets. For this purpose, we perform particle-in-cell simulations of the driven formation of thin current sheets, and their subsequent evolution either to equilibrium or to instability of a tearing-type mode. In the latter case we will pay particular attention to the nature of the electric field contribution which unmagnetizes the electrons.
Author

Magnetic Field Reconnection; Dynamic Characteristics; Kinetic Energy; Numerical Analysis

19990105697 NASA Marshall Space Flight Center, Huntsville, AL USA

Ion Transport in the September 24, 1998 CME Event

Chandler, M. O., NASA Marshall Space Flight Center, USA; Craven, P. D., NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 19-25 Sep. 1999, Yellowstone, WY, USA; Sponsored by Lawrence Livermore National Lab., USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

On 24 September 1998 Earth's magnetosphere was impacted by a large CME with an associated shock front. This impact moved the magnetopause inward by several Re and pushed dayside magnetospheric boundaries anti-sunward by more than 1 Re. The resulting observations from the Polar spacecraft, which was located over the northern polar cap, show signatures of the polar cap, the cusp, and the mantle as these regions were moved across the spacecraft position. An enhanced Cleft Ion Fountain outflow was observed as Polar moved sunward towards the cusp following the shock passage. Analysis of these data shows the velocity filter/mass spectrometer nature of the CIF in association with anti-sunward convection. These signatures are used to investigate time scales for reconnection, energy transfer to the Ionosphere, and CIF outflow generation.
Author

Ion Irradiation; Energy Transfer; Shock Fronts; Magnetopause; Earth Magnetosphere

19990105698 NASA Marshall Space Flight Center, Huntsville, AL USA

Global Observations of Poleward Moving Aurora on the Dayside

Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Fillingim, M. O., NASA Marshall Space Flight Center, USA; Chua, D., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Spann, J. F., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 12-17 Dec. 1999, San Francisco, CA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Auroral arcs found at high latitude that move poleward from the nominal dayside oval, also known as poleward moving auroral forms been extensively studied from ground-based all-sky camera and meridian scanning photometric measurements. These auroral forms are thought to be he ionospheric signature of dayside reconnection processes at the magnetopause and therefore important for determining the relationship between the solar wind interplanetary magnetic field (IMF) and the location and size

of the reconnection region. The large-scale picture of these dayside phenomenon derived from satellite imagery, however, has not been fully developed. Observations from the Polar Ultraviolet Imager (UVI) have sufficient time and spatial resolution to examine the longitudinal extent and motion of high-latitude arcs that extend across several hours of magnetic local time in the dayside aurora. We discuss the size and evolution of moving dayside aurorae in relation to the solar wind IMF orientation. We show also that the intensity of these auroral features is related to both solar wind pressure pulses and nightside auroral intensifications.
Author

Global Positioning System; Auroral Arcs; Images; Magnetic Field Reconnection; Satellite Imagery

19990105816 NASA Marshall Space Flight Center, Huntsville, AL USA

Global Observation of Substorm Growth Phase Processes in the Polar Caps

Brittnacher, M., Washington Univ., USA; OFillingim, M. O., Washington Univ., USA; Chua, D., Washington Univ., USA; Wilber, M., Washington Univ., USA; Parks, G. K., Washington Univ., USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J. F., NASA Marshall Space Flight Center, USA; 1998; In English, 28 Oct. 1998, Guntersville, AL, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Global images of the polar cap region during the substorm growth phase by the Polar Ultraviolet Imager reveals evidence of the processes which are not completely explained by current models. In particular, it was found that size of the polar cap region increases during the growth phase even if the interplanetary magnetic field has no southward component. Three phenomena were observed to produce an increase in the size of the polar cap: (1) motion of the auroral oval to lower latitude, (2) thinning of the auroral oval, and (3) reduction of intense aurora[precipitation in the polar region. Correlation of image intensities with in situ particle measurements from the FAST satellite are being conducted to study the three growth phase phenomena; and to help identify the source regions of the particles, the mechanisms involved in producing the auroral structures and what may be reducing the polar cap precipitation during the substorm growth phase.
Author

Auroras; Magnetic Storms; Polar Caps; Polar Regions; Solar Storms

19990105822 NASA Marshall Space Flight Center, Huntsville, AL USA

A New Synoptic Scale Feature of the Auroral Oval: The Nightside Gap

Cliua, D., Washington Univ., USA; Brittnacher, M., Washington Univ., USA; Parks, G. K., Washington Univ., USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J. F., NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Th Polar Ultraviolet Imager (UVI) has recently identified a new morphological feature of the nightside aurora in which a well defined segment of the pre-midnight auroral oval, typically spanning 1.0- 1.5 hours in local time (710-1100 km), exhibits a significant reduction in luminosity relative to the active regions surrounding it. This feature appears in roughly 7% of the substorm period observed during our initial study spanning December 1996 through February, 1997. The energy flux (erg/sq cm/s) is shown to be lower by as much as a factor of four in this nightside gaps in comparison to the adjacent auroral activity. Substorm intensifications are often observed on either side of the nightside gap, which remains relatively inactive during these substorm periods. We demonstrate that the nightside gap is sometimes terminated by the onset of a substorm directly within the same local time boundaries. The nightside gap has strong implications for the dynamics of magnetosphere-ionosphere coupling and current closure in the midnight sector auroral oval. Specifically, we conjecture that the nightside gap occurs when transverse ionospheric currents do not feed into upward field-aligned currents in the midnight sector, perhaps due to the Harang discontinuity.
Author

Auroral Zones; Auroras; Field Aligned Currents; Ionospheric Currents; Magnetic Storms; Polar Regions

19990106246 NASA Marshall Space Flight Center, Huntsville, AL USA

Global Imaging Mission

Lumnierzheim, D., Alaska Univ., USA; Spann, J., NASA Marshall Space Flight Center, USA; Parks, G., Washington Univ., USA; Oct. 26, 1998; In English; 6th New Millennium Magnetosphere: Integrating Imaging, Discrete Observations, and Global Simulations, 29 Oct. 1998, Guntersville, AL, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Recent correlative observations have advanced our understanding of the solar-terrestrial environment. Among the suite of useful measurements, global auroral images have proven to be useful in guiding global models. Global auroral images provide an irreplaceable contextual measure that is required for understanding the momentum and mass transfer between the magnetosphere and ionosphere, and required for understanding their dynamic response to the solar wind. Global auroral images can provide much more than contextual information. Quantitative data, such as hemispheric power input distribution on a global scale provides needed information with regards to the dynamic nature of the magnetosphere. However, truly global images (both hemi-

spheres simultaneously) with appropriate temporal, spectral and spatial resolution are needed in order to fully comprehend the dynamic nature of the magnetosphere. Differences in response of the two hemispheres as a function of time, space, and energy, provide needed boundary conditions for models as well as a gateway to understand the mechanism relevant to the provide a quantitative measure of the magnetosphere, A mission concept based on the need to provide a quantitative measure of the global distribution of the power input and average energy including in-situ particle measurement will be described.
Author
Imagery; Solar Wind; Temporal Resolution; Mission Planning; Imaging Techniques; Boundary Conditions

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METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

19990100624 Los Alamos National Lab., Space and Atmospheric Sciences Group, NM USA
Operation of an array of field-change detectors to provide ground truth for FORTE data
Massey, R. S.; Eack, K. B.; Eberle, M. H.; Shao, X. M.; Smith, D. A.; Dec. 31, 1999; 5p; In English; 11th; Atmospheric electricity (ICAE 1999)
Report No.(s): DE99-002736; LA-UR-99-868; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The authors have deployed an array of fast electric-field-change sensors around the state of New Mexico to help identify the lightning processes responsible for the VHF RF signals detected by the FORTE satellite's wide-band transient radio emission receivers. The array provides them with locations and electric-field waveforms for events within New Mexico and into surrounding states, and operates continuously. They are particularly interested in events for which there are coincident FORTE observations. For these events, they can correct both the array and FORTE waveforms for time of flight, and can plot the two waveforms on a common time axis. Most of the coincident events are from cloud-go-ground discharges, but the most powerful are from a little-studied class of events variously called narrow bipolar events and compact intra-cloud discharges. They have therefore focused their attention on these events whether or not FORTE was in position to observe them.
NTIS
Electric Fields; Ground Truth; Detectors; Arrays

19990100633 Meteorological Satellite Center, Kiyose, Japan
Monthly Report of the Meteorological Satellite Center: September 1999
September 1998; 1p; In English; CD-ROM: CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity, CD-ROM

The CD-ROM concerning the September 1998 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.
Derived from text
Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

19990100634 NASA Langley Research Center, Hampton,VA USA
Surface Emissivity Maps for Use in Satellite Retrievals of Longwave Radiation
Wilber, Anne C., Analytical Services and Materials, Inc., USA; Kratz, David P., NASA Langley Research Center, USA; Gupta, Shashi K., Analytical Services and Materials, Inc., USA; August 1999; 35p; In English; Original contains color illustrations
Contract(s)/Grant(s): RTOP 291-01-60
Report No.(s): NASA/TP-1999-209362; L-17861; NAS 1.60:209362; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Accurate accounting of surface emissivity is essential for the retrievals of surface temperature from remote sensing measurements, and for the computations of longwave (LW) radiation budget of the Earth?s surface. Past studies of the above topics assumed that emissivity for all surface types, and across the entire LW spectrum is equal to unity. There is strong evidence, however, that emissivity of many surface materials is significantly lower than unity, and varies considerably across the LW spectrum.

We have developed global maps of surface emissivity for the broadband LW region, the thermal infrared window region (8-12 micron), and 12 narrow LW spectral bands. The 17 surface types defined by the International Geosphere Biosphere Programme (IGBP) were adopted as such, and an additional (18th) surface type was introduced to represent tundra-like surfaces. Laboratory measurements of spectral reflectances of 10 different surface materials were converted to corresponding emissivities. The 10 surface materials were then associated with 18 surface types. Emissivities for the 18 surface types were first computed for each of the 12 narrow spectral bands. Emissivities for the broadband and the window region were then constituted from the spectral band values by weighting them with Planck function energy distribution.
Author

Surface Temperature; Temperature Sensors; Surface Properties; Computation; Long Wave Radiation

19990100637 NASA Marshall Space Flight Center, Huntsville, AL USA
Lightning Strike Peak Current Probabilities as Related to Space Shuttle Operations
Johnson, Dale L., NASA Marshall Space Flight Center, USA; Vaughan, William W., Alabama Univ., USA; 2000; 14p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A summary is presented of basic lightning characteristics/criteria applicable to current and future aerospace vehicles. The paper provides estimates on the probability of occurrence of a 200 kA peak lightning return current, should lightning strike an aerospace vehicle in various operational phases, i.e., roll-out, on-pad, launch, reenter/land, and return-to-launch site. A literature search was conducted for previous work concerning occurrence and measurement of peak lighting currents, modeling, and estimating the probabilities of launch vehicles/objects being struck by lightning. This paper presents a summary of these results.
Author

Lightning; Atmospheric Electricity; Aerospace Vehicles; Launch Vehicles; Launch Dates; Spacecraft Launching

19990100651 NASA Goddard Space Flight Center, Greenbelt, MD USA
Wind Speed Measurement from Bistatically Scattered GPS Signals
Garrison, James L., NASA Goddard Space Flight Center, USA; Komjathy, Attila, Colorado Univ., USA; Zavorotny, Valery U., National Oceanic and Atmospheric Administration, USA; Katzberg, Stephen J., NASA Langley Research Center, USA; IEEE Transactions on Geoscience and Remote Sensing; [1999]; Volume 20, No. Y, pp. 100-130; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Instrumentation and retrieval algorithms are described which use the forward, or bistatically scattered range-coded signals from the Global Positioning System (GPS) radio navigation system for the measurement of sea surface roughness. This roughness is known to be related directly to the surface wind speed. Experiments were conducted from aircraft along the TOPEX ground track, and over experimental surface truth buoys. These flights used a receiver capable of recording the cross correlation power in the reflected signal. The shape of this power distribution was then compared against analytical models derived from geometric optics. Two techniques for matching these functions were studied. The first recognized the most significant information content in the reflected signal is contained in the trailing edge slope of the waveform. The second attempted to match the complete shape of the waveform by approximating it as a series expansion and obtaining the nonlinear least squares estimate. Discussion is also presented on anomalies in the receiver operation and their identification and correction.
Author

Ground Wind; Wind Velocity; Wind Measurement; Sea Breeze; Surface Roughness

19990100654 NASA Goddard Space Flight Center, Greenbelt, MD USA
Data Assimilation in the Presence of Forecast Bias: The GEOS Moisture Analysis
Dee, Dick P., NASA Goddard Space Flight Center, USA; Todling, Ricardo, NASA Goddard Space Flight Center, USA; Sep. 10, 1999; 34p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe the application of the unbiased sequential analysis algorithm developed by Dee and da Silva (1998) to the GEOS DAS moisture analysis. The algorithm estimates the persistent component of model error using rawinsonde observations and adjusts the first-guess moisture field accordingly. Results of two seasonal data assimilation cycles show that moisture analysis bias is almost completely eliminated in all observed regions. The improved analyses cause a sizable reduction in the 6h-forecast bias and a marginal improvement in the error standard deviations.
Author

Sequential Analysis; Sorting Algorithms; Computer Techniques; Earth Observing System (EOS); Computerized Simulation; Numerical Weather Forecasting; Atmospheric General Circulation Models

19990100656 NASA Goddard Space Flight Center, Greenbelt, MD USA
Vertical Photon Transport in Cloud Remote Sensing Problems
Platnick, S., NASA Goddard Space Flight Center, USA; Aug. 27, 1999; 40p; In English
Contract(s)/Grant(s): NAG5-6006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Photon transport in plane-parallel, vertically inhomogeneous clouds is investigated and applied to cloud remote sensing techniques that use solar reflectance or transmittance measurements for retrieving droplet effective radius. Transport is couched in terms of weighting functions which approximate the relative contribution of individual layers to the overall retrieval. Two vertical weightings are investigated, including one based on the average number of scatterings encountered by reflected and transmitted photons in any given layer. A simpler vertical weighting based on the maximum penetration of reflected photons proves useful for solar reflectance measurements. These weighting functions are highly dependent on droplet absorption and solar/viewing geometry. A superposition technique, using adding/doubling radiative transfer procedures, is derived to accurately determine both weightings, avoiding time consuming Monte Carlo methods. Superposition calculations are made for a variety of geometries and cloud models, and selected results are compared with Monte Carlo calculations. Effective radius retrievals from modeled vertically inhomogeneous liquid water clouds are then made using the standard near-infrared bands, and compared with size estimates based on the proposed weighting functions. Agreement between the two methods is generally within several tenths of a micrometer, much better than expected retrieval accuracy. Though the emphasis is on photon transport in clouds, the derived weightings can be applied to any multiple scattering plane-parallel radiative transfer problem, including arbitrary combinations of cloud, aerosol, and gas layers.
Author
Photons; Radiative Transfer; Remote Sensing; Weighting Functions

19990100663 NASA Goddard Space Flight Center, Greenbelt, MD USA
Determination of Radiative Forcing of Saharan Dust using Combined TOMS and ERBE Data
Hsu, N. Christina, Raytheon STX Corp., USA; Herman, Jay R., NASA Goddard Space Flight Center, USA; Weaver, Clark, SM and A Corp., USA; 1999; 42p; In English; Original contains color illustrations; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The direct radiative forcing of Saharan dust aerosols has been determined by combining aerosol information derived from Nimbus-7 TOMS with radiation measurements observed at the top of atmosphere (TOA) by NOAA-9 ERBE made during February-July 1985. Cloud parameters and precipitable water derived from the NOAA-9 HIRS2 instrument were used to aid in screening for clouds and water vapor in the analyses. Our results indicate that under "cloud-free" and "dry" conditions there is a good correlation between the ERBE TOA outgoing longwave fluxes and the TOMS aerosol index measurements over both land and ocean in areas under the influence of airborne Saharan dust. The ERBE TOA outgoing shortwave fluxes were also found to correlate well with the dust loading derived from TOMS over ocean. However, the calculated shortwave forcing of Saharan dust aerosols is very weak and noisy over land for the range of solar zenith angle viewed by the NOAA-9 ERBE in 1985. Sensitivity factors of the TOA outgoing fluxes to changes in aerosol index were estimated using a linear regression fit to the ERBE and TOMS measurements. The ratio of the shortwave-to-longwave response to changes in dust loading over the ocean is found to be roughly 2 to 3, but opposite in sign. The monthly averaged "clear-sky" TOA direct forcing of airborne Saharan dust was also calculated by multiplying these sensitivity factors by the TOMS monthly averaged "clear-sky" aerosol index. Both the observational and theoretical analyses indicate that the dust layer height, ambient moisture content as well as the presence of cloud all play an important role in determining the TOA direct radiative forcing due to mineral aerosols.
Author
Aerosols; Dust; Air Pollution; Sahara Desert (Africa); Solar Radiation; Troposphere

19990100870 NASA Marshall Space Flight Center, Huntsville, AL USA
The Multi-Center Airborne Coherent Atmospheric Wind Sensor: Recent Measurements and Future Applications
Rothermel, Jeffry, NASA Marshall Space Flight Center, USA; Cutten, Dean R., NASA Marshall Space Flight Center, USA; Howell, Burgess F., NASA Marshall Space Flight Center, USA; Hardesty, Robert M., NASA Marshall Space Flight Center, USA; Tratt, David M., NASA Marshall Space Flight Center, USA; Darby, Lisa S., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 10th; Coherent Laser Radar, 28 Jun. - 2 Jul. 1999, Mount Hood, OR, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The atmospheric lidar remote sensing groups of NOAA Environmental Technology Laboratory, Jet Propulsion Laboratory and NASA Marshall Space Flight Center jointly developed an airborne scanning coherent Doppler Lidar. We describe the system,

present recent measurement (including the first wind fields measured within a hurricane using Doppler lidar), and describe prospective instrument improvements and research applications.

Author

Wind (Meteorology); Optical Radar; Atmospheric Sounding; Remote Sensing; Airborne Radar; Coherent Radar

19990100964 NASA Goddard Space Flight Center, Greenbelt, MD USA

Unstable Air-Sea Interaction in the Extratropical North Atlantic

Hakkinen, Sirpa, NASA Goddard Space Flight Center, USA; Aug. 20, 1999; 13p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    The possibility of coupled modes in the extratropical North Atlantic has fascinated the climate community since 1960's. A significant aspect of such modes is an unstable air-sea interaction, also called positive feedback, where disturbances between the atmosphere and ocean grow unbound. If a delayed response exists before the negative feedback takes effect, an oscillatory behaviour will develop. Here we explore the relationship between heat flux (positive upward) and sea surface temperature (SST). Positive feedback is characterized by a cross-correlation between the two where correlation maintains a negative sign whether SST or heat flux leads. We use model results and observations to argue that in the North Atlantic there exist regions with positive feedback. The two main locations coincide with the well-known north-south SST dipole where anomalies of opposite sign occupy areas east of Florida and north-east of Newfoundland. We show that oceanic dynamics, wave propagation and advection, give rise to oceanic anomalies in these regions. Subsequently these anomalies are amplified by atmosphere- ocean interaction: thus a positive feedback.

Derived from text

Air Water Interactions; Atlantic Ocean; Coupled Modes; Heat Flux; Ocean Dynamics; Sea Surface Temperature

19990101416 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: July 1999

July 1999; 1p; In English; CD-ROM: CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity, CD-ROM

    The CD-ROM concerning the July 1999 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.

Author

Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

19990101417 Meteorological Satellite Center, Kiyose, Japan

Monthly Report of the Meteorological Satellite Center: June 1999

June 1999; 1p; In English; CD-ROM: CD-ROM conforms to the ISO 9660 standard for volume and file structure; Copyright; Avail: Issuing Activity, CD-ROM

    The CD-ROM concerning the June 1999 Monthly Report of the Meteorological Satellite Center (MSC) contains the observation data derived from the Geostationary Meteorological Satellite (GMS) of Japan and the Polar Orbital Meteorological Satellites operated by NOAA. The CD-ROM contains the following observation data: Full Disk Earth's Cloud Image; Cloud Image of Japan and its vicinity; Cloud Amount; Sea Surface Temperature; Cloud Motion Wind; Water Vapor Motion Wind; Equivalent Blackbody Temperature; OLR (Out-going Longwave Radiation), Solar Radiation; Snow and Ice Index; Orbit Data; Attitude Data; VISSR Image Data Catalog (Cartridge Magnetic Tape (CMT), Micro Film); TOVS (TIROS Operational Vertical Sounder) Vertical Profile of Temperature and Precipitable Water; and TOVS Total Ozone Amount.

Author

Satellite Observation; Satellite Sounding; Atmospheric Sounding; Meteorological Parameters; Satellite Imagery; Japan

19990102415 NASA Marshall Space Flight Center, Huntsville, AL USA

Cloud Filtering Using a Bi-Spectral Spatial Coherence Approach

Guillory, Anthony R., NASA Marshall Space Flight Center, USA; Lecue, Juan M., Instituto Nacional de Tecnica Aeroespacial, Spain; Jedlovec, Gary J., NASA Marshall Space Flight Center, USA; Whitworth, Brandon N., Alabama Univ., USA; 1998; In

English; 9th; Satellite Meteorology and Oceanography, 25-29 May 1998, Paris, France; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The research in this paper focuses on describing a technique developed for cloud filtering using a bi-spectral approach on GOES-8/9 Imager data. The application was developed for use with infrared retrievals of geophysical parameters in mind, where cloud cover contaminates the derived product. However, numerous potential applications of the technique exist. The technique will be described and a preliminary validation of the algorithm will be presented. Although initially based on the spatial coherence approach from Coakley and Brethereton (1982), it has evolved to utilize a difference image of the 11 and 3.9 micrometer channels on the GOES-8/9 Imager. This image is very similar to that produced by Nelson and Ellrod (1996). During the daytime the technique makes use of the varying solar reflectance in the 3.9 micrometer channel by clouds and land to identify cloudy pixels. While at night, the technique makes use of the varying emissivity of the clouds in the scene to discriminate between clear and cloudy pixels. The technique applies three basic threshold tests to produce the final cloud filtered image: 1) a standard deviation threshold to detect the spatial variance in the scene, 2) a difference threshold between adjacent pixels, and 3) a simple infrared temperature threshold. The first test is applied to the entire image at once, then in a second pass the next two tests are applied. The final infrared temperature threshold is only meant to identify the coldest clouds that might pass the previous tests. The technique performs well during the daytime, while nighttime performance is degraded but is promising. The technique has proven to be robust and shows great promise of meeting its original goal of cloud filtering for use in an infrared retrieval algorithm for use in climate studies.
Author

Spectrum Analysis; Infrared Radiation; Solar Radiation

19990102419 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Potential for Predicting Precipitation on Seasonal-to-Interannual Timescales
Koster, R. D., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 10-12 May 1999, Atlanta, GA, USA; Sponsored by American Water Resources Association; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The ability to predict precipitation several months in advance would have a significant impact on water resource management. This talk provides an overview of a project aimed at developing this prediction capability. NASA's Seasonal-to-Interannual Prediction Project (NSIPP) will generate seasonal-to-interannual sea surface temperature predictions through detailed ocean circulation modeling and will then translate these SST forecasts into forecasts of continental precipitation through the application of an atmospheric general circulation model and a "SVAT"-type land surface model. As part of the process, ocean variables (e.g., height) and land variables (e.g., soil moisture) will be updated regularly via data assimilation. The overview will include a discussion of the variability inherent in such a modeling system and will provide some quantitative estimates of the absolute upper limits of seasonal-to-interannual precipitation predictability.
Author

Atmospheric General Circulation Models; Forecasting; Predictions; Variability; Precipitation (Meteorology); Long Range Weather Forecasting; Numerical Weather Forecasting; Climatology; Periodic Variations

19990102420 NASA Goddard Inst. for Space Studies, New York, NY USA
Modeled Impact of Cirrus Cloud Increases Along Aircraft Flight Paths
Rind, David, NASA Goddard Inst. for Space Studies, USA; Lonergan, P., NASA Goddard Inst. for Space Studies, USA; Shah, K., NASA Goddard Inst. for Space Studies, USA; 1999; 1p; In English; Atmospheric Effects of Aviation, 19-23 Apr. 1999, Virginia Beach, VA, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The potential impact of contrails and alterations in the lifetime of background cirrus due to subsonic airplane water and aerosol emissions has been investigated in a set of experiments using the GISS GCM connected to a q-flux ocean. Cirrus clouds at a height of 12-15km, with an optical thickness of 0.33, were input to the model "x" percentage of clear-sky occasions along subsonic aircraft flight paths, where x is varied from .05% to 6%. Two types of experiments were performed: one with the percentage cirrus cloud increase independent of flight density, as long as a certain minimum density was exceeded; the other with the percentage related to the density of fuel expenditure. The overall climate impact was similar with the two approaches, due to the feedbacks of the climate system. Fifty years were run for eight such experiments, with the following conclusions based on the stable results from years 30-50 for each. The experiments show that adding cirrus to the upper troposphere results in a stabilization of the atmosphere, which leads to some decrease in cloud cover at levels below the insertion altitude. Considering then the total effect on upper level cloud cover (above 5 km altitude), the equilibrium global mean temperature response shows that altering high level clouds by 1% changes the global mean temperature by 0.43C. The response is highly linear (linear correlation coefficient of 0.996) for high cloud cover changes between 0. 1% and 5%. The effect is amplified in the Northern Hemisphere, more so with greater cloud cover change. The temperature effect maximizes around 10 km (at greater than 40C warming with a 4.8% increase in upper level

clouds), again more so with greater warming. The high cloud cover change shows the flight path influence most clearly with the smallest warming magnitudes; with greater warming, the model feedbacks introduce a strong tropical response. Similarly, the surface temperature response is dominated by the feedbacks, and shows little geographical relationship to the high cloud input. Considering whether these effects would be observable, changing upper level cloud cover by as little as 0.4% produces warming greater than 2 standard deviations in the Microwave Sounding Unit (MSU) channels 4, 2 and 2r, in flight path regions and in the subtropics. Despite the simplified nature of these experiments, the results emphasize the sensitivity of the modeled climate to high level cloud cover changes, and thus the potential ability of aircraft to influence climate by altering clouds in the upper troposphere. Author

Cirrus Clouds; Cloud Cover; Contrails; Flight Paths; Atmospheric General Circulation Models; Climatology; Numerical Weather Forecasting; Aviation Meteorology; Computerized Simulation; Meteorological Parameters

19990102421 NASA Goddard Space Flight Center, Greenbelt, MD USA

Airborne Radar Observations of Hurricane Georges during Landfall over the Dominican Republic

Geerts, B., NASA Goddard Space Flight Center, USA; Heymsfield, G., NASA Goddard Space Flight Center, USA; Tian, L., Universities Space Research Association, USA; 1999; 2p; In English, 19-20 Apr. 1999, Netherlands; Sponsored by European Geophysical Society; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

On 22 September 1998 hurricane Georges made landfall on the Dominican Republic (DR). Georges cost the DR at least 500 lives, made more than 155,000 people homeless and caused extensive damage to the country's main industries, tourism and agriculture. There was considerable wind damage, with wind gusts up to 58 m/s in Santo Domingo on the south coast, but most of the damage and deaths resulted from mudslides and the flooding of rivers. While this may have been the worst natural disaster to strike the DR, the sustained rapid storm movement saved the island from worse damage. Georges had previously affected several islands in the Lesser Antilles and Puerto Rico, but it had retained much of its circulation strength. Forty raingauge stations across the DR measured rainfall totals from Georges between 0.7 and 41 cm, the latter at the capital Santo Domingo, located on the south coast. At Herrera the maximum 1 h rainfall rate was 72 mm/h. It is suspected that much higher rain rates occurred in DR's mountainous interior. Before landfall the eye was clearly evident in satellite imagery. When the eye moved over southeastern DR, it filled rapidly, and the cloud top height decreased in all storm sectors except in the southern inflow sector, where a long-lived MCS, with a diameter larger than that of the eyewall, slowly became enwrapped in the hurricane circulation. The eye closure was most rapid between 16-18 UTC, when the eyewall circulation felt the mountainous terrain of the Cordillera Central, which rises up to 3,093 m. The estimated central pressure increased from 962 hPa at 15 UTC to 986 hPa at 03Z on 23 Sept, and the maximum sustained surface wind speed decreased from 54 to 36 in s-1 during the same period. The island of Hispaniola has a cross-track width of about 250 km, much wider than the diameter of the eyewall anvil (about 100 km before landfall). So the event can truly be considered to be a landfalling case, even though Georges recovered after crossing Hispaniola, albeit never to the same strength. This talk will summarize satellite and ground observations of Georges, as it passed the DR, and it will focus on EDOP data. In particular, we will try to estimate the rainfall rate over the mountainous terrain of the DR. And we will use detailed sounding data to explain the presence and characteristics of the massive MCS to the south, as well as the upper-level updrafts apparent over this MCS and over the mountains of the DR. Author

Dominican Republic; Hurricanes; Rain; Storms; Terrain; Climatology; Vertical Air Currents

19990102422 NASA Goddard Space Flight Center, Greenbelt, MD USA

Radar Observations of Convective Systems from a High-Altitude Aircraft

Heymsfield, G., NASA Goddard Space Flight Center, USA; Geerts, B., NASA Goddard Space Flight Center, USA; Tian, L., Universities Space Research Association, USA; 1999; 2p; In English, 19-20 Apr. 1999, Netherlands; Sponsored by European Geophysical Society; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Reflectivity data collected by the precipitation radar on board the tropical Rainfall Measuring Mission (TRMM) satellite, orbiting at 350 km altitude, are compared to reflectivity data collected nearly simultaneously by a doppler radar aboard the NASA ER-2 flying at 19-20 km altitude, i.e. above even the deepest convection. The TRMM precipitation radar is a scanning device with a ground swath width of 215 km, and has a resolution of about a4.4 km in the horizontal and 250 m in the vertical (125 m in the core swath 48 km wide). The TRMM radar has a wavelength of 217 cm (13.8 GHz) and the Nadir mirror echo below the surface is used to correct reflectivity for loss by attenuation. The ER-2 Doppler radar (EDOP) has two antennas, one pointing to the nadir, 34 degrees forward. The forward pointing beam receives both the normal and the cross-polarized echos, so the linear polarization ratio field can be monitored. EDOP has a wavelength of 3.12 cm (9.6 GHz), a vertical resolution of 37.5 m and a horizontal along-track resolution of about 100 m. The 2-D along track airflow field can be synthesized from the radial velocities of both beams, if a reflectivity-based hydrometer fall speed relation can be assumed. It is primarily the superb vertical resolution that distinguishes

EDOP from other ground-based or airborne radars. Two experiments were conducted during 1998 into validate TRMM reflectivity data over convection and convectively-generated stratiform precipitation regions. The Teflun-A (TEXAS-Florida Underflight) experiment, was conducted in April and May and focused on mesoscale convective systems mainly in southeast Texas. TEFLUN-B was conducted in August-September in central Florida, in coordination with CAMEX-3 (Convection and Moisture Experiment). The latter was focused on hurricanes, especially during landfall, whereas TEFLUN-B concentrated on central; Florida convection, which is largely driven and organized by surface heating and ensuing sea breeze circulations. Both TEFLUN-A and B were amply supported by surface data, in particular a dense raingauge network, a polarization radar, wind profilers, a mobile radiosonde system, a cloud physics aircraft penetrating the overflown storms, and a network of 10 cm Doppler radars(WSR-88D). This presentation will show some preliminary comparisons between TRMM, EDOP, and WSR-88D reflectivity fields in the case of an MCS, a hurricane, and less organized convection in central Florida. A validation of TRMM reflectivity is important, because TRMM's primary objective is to estimate the rainfall climatology with 35 degrees of the equator. Rainfall is estimated from the radar reflectivity, as well from TRMM's Microwave Imager, which measures at 10.7, 19.4, 21.3, 37, and 85.5 GHz over a broader swath (78 km). While the experiments lasted about three months the cumulative period of near simultaneous observations of storms by ground-based, airborne and space borne radars is only about an hour long. Therefore the comparison is case-study-based, not climatological. We will highlight fundamental differences in the typical reflectivity profiles in stratiform regions of MCS's, Florida convection and hurricanes and will explain why Z-R relationships based on ground-based radar data for convective systems over land should be different from those for hurricanes. These catastrophically intense rainfall from hurricane Georges in Hispaniola and from Mitch in Honduras highlights the importance of accurate Z-R relationships, It will be shown that a Z-R relationship that uses the entire reflectivity profile (rather than just a 1 level) works much better in a variety of cases, making an adjustment of the constants for different precipitation system categories redundant.
Author

Climatology; Convection; Florida; Hurricanes; Meteorological Radar; Precipitation (Meteorology); Radar Data; Rain; Reflectance; Trmm Satellite; Tropical Meteorology; Atmospheric Circulation

19990102609 NASA Goddard Space Flight Center, Greenbelt, MD USA
Seasonal-to-Interannual Precipitation Variability and Predictability in a Coupled Land-Atmosphere System
Koster, Randal D., NASA Goddard Space Flight Center, USA; Suarez, M. J., NASA Goddard Space Flight Center, USA; Heiser, M., General Sciences Corp., USA; 1998; 1p; In English; 14th; 79th; Hydrology, Dallas, TX, Unknown, USA; Sponsored by American Meteorological Society, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

In an earlier GCM study, we showed that interactive land surface processes generally contribute more to continental precipitation variance than do variable sea surface temperatures (SSTs). A new study extends this result through an analysis of 16-member ensembles of multi-decade GCM simulations. We can now show that in many regions, although land processes determine the amplitude of the interannual precipitation anomalies, variable SSTs nevertheless control their timing. The GCM data can be processed into indices that describe geographical variations in (1) the potential for seasonal-to-interannual prediction, and (2) the extent to which the predictability relies on the proper representation of land-atmosphere feedback.
Author

Earth Surface; Predictions; Sea Surface Temperature; Variability; Air Land Interactions; Precipitation (Meteorology); Hydrology Models; Atmospheric General Circulation Models; Meteorology

19990102623 NASA Marshall Space Flight Center, Huntsville, AL USA
A Diagnostic Analysis of the Kennedy Space Center LDAR Network
Boccippio, Dennis J., NASA Marshall Space Flight Center, USA; Heckman, G., NASA Marshall Space Flight Center, USA; Goodman, Steven, NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 11th; Atmospheric Electricity, 7-11 Jun. 1999, Guntersville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The performance characteristics of the Kennedy Space Center Lightning Detection and Ranging (LDAR) network are investigated at medium-far range (50-300 km). A 19 month noise-filtered sample of LDAR observations is examined, from which it is determined that the "climatological" VHF source density as observed by LDAR falls off approximately 10 dB every 71 km of ground range from the network centroid. The underlying vertical distribution of LDAR sources is approximately normally distributed with a mean of 9 km and a standard deviation of 2.7 km, implying that loss of below-horizon sources has a negligible effect on column-integrated source densities within 200 km ground range. At medium to far ranges, location errors are primarily radial and have a slightly asymmetric distribution whose first moment increases as r(exp 2). A range calibration derived from these

results is used to normalize source density maps on monthly, daily and hourly time scales and yields significant improvements in correlation with NLDN ground strike densities.

Author

Lighting Equipment; Performance Prediction; Rangefinding; Lightning; Detection; Calibrating

19990102624 NASA Marshall Space Flight Center, Huntsville, AL USA

Evidence for the Absence of Conductivity Variations above Thunderstorms

Bailey, Jeff C., Raytheon Co., USA; Blakeslee, Richard J., NASA Marshall Space Flight Center, USA; Driscoll, Kevin T., Alabama Univ., USA; 1999; In English; Atmospheric Electricity, 7-11 Jun. 1999, Guntersville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In recent years, atmospheric conductivity and electric field measurements over thunderstorms have been made at 20 km with a high altitude aircraft. After compensating for the effects of aircraft charging induced by external electric fields no significant variations in ambient conductivity above thunderstorms have been found. These Gerdien results contrast strongly with the large (and frequent) conductivity variations reported in studies using relaxation probe techniques.

Author

Thunderstorms; Atmospheric Conductivity; Electrical Measurement; Electric Fields

19990102625 NASA Marshall Space Flight Center, Huntsville, AL USA

Land-Ocean Differences in LIS and OTD Tropical Lightning Observations

Boccippio, Dennis J., NASA Marshall Space Flight Center, USA; Koshak, W. J., NASA Marshall Space Flight Center, USA; Christian, Hugh J., NASA Marshall Space Flight Center, USA; Goodman, Steven, NASA Marshall Space Flight Center, USA; 1999; In English; 11th; Atmospheric Electricity, 7-11 Jun. 1999, Guntersville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Significant differences are known to exist on a global scale between continental and oceanic total lightning regional flash rates, suggesting differences in the properties of convective storms in these regimes. Lightning properties observed by the Optical Transient Detector (OTD) and Lightning Imaging Sensor (LIS) over land and ocean are compared, limited to analysis over the tropics in order to simplify physical interpretation. We find that the mean flash rates of individual storms over tropical land only exceed those over ocean by a factor of 2 (far less than the observed differences in regional flash rates). However, the average nearest neighbor distance of continental thunderstorms in half that over oceans. Cloud-top lightning optical radiance in oceanic storms is also twice as large as over land, suggesting either more energetic flashes over the oceans or less intervening cloud particles.

Author

Oceans; Thunderstorms; Marine Meteorology; Lightning

19990102626 NASA Marshall Space Flight Center, Huntsville, AL USA

Global Frequency and Distribution of Lightning as Observed by the Optical Transient Detector (OTD)

Christian, Hugh J., NASA Marshall Space Flight Center, USA; Blakeslee, Richard J., NASA Marshall Space Flight Center, USA; Boccippio, Dennis J., NASA Marshall Space Flight Center, USA; Boeck, William L., Niagara Univ., USA; Buechler, Dennis E., Alabama Univ., USA; Driscoll, Kevin T., Alabama Univ., USA; Goodman, Steven J., NASA Marshall Space Flight Center, USA; Hall, John M., Computer Sciences Corp., USA; Koshak, William J., NASA Marshall Space Flight Center, USA; Mach, Douglas M., Alabama Univ., USA; 1999; In English; 11th; Atmospheric Electricity, 7-11 Jun. 1999, Guntersville, AL, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Optical Transient Detector (OTD) is a space-based instrument specifically designed to detect and locate lightning discharges (intracloud and cloud-to-ground) as it orbits the Earth. A statistical examination of OTD lightning data reveals that nearly 1.2 billion flashes occurred over the entire earth during the one year period from September 1995 through August 1996. This translates to an average of 37 lightning flashes occurring around the globe every second, which is well below the traditional estimate of 100 flashes per second. An average of 75% of the global lightning activity during the year occurs between 30 deg S and 30 deg N. An analysis of the annual lightning distribution reveals that an average of 82% of the lightning flashes occur over the continents and 18% over the oceans, which translates to an average land-ocean flash density ratio of nearly 11.

Author

Satellite-Borne Instruments; Optical Equipment; Lightning; Frequencies

NASA Marshall Space Flight Center, Huntsville, AL USA

Statistical Aspects of Intense Hurricanes in the Atlantic Basin during the Past 49 Hurricane Seasons (1950-1998), 1950-1998

Wilson, Robert M., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Statistical aspects of intense hurricanes (those of category 3 or higher) in the Atlantic basin for the interval of 1950-1998 are investigated with respect to the ENSC, cycle and the postulated 'more versus less' activity modes for intense hurricane activity. This is accomplished in order to evaluate the statistical basis for these specific groupings and to presage a forecast for the number of expected intense hurricanes during the forthcoming 1999 hurricane season. Statistically speaking, because the 1998-1999 La Nina (onset presumed to be September 1998) should persist longer than about a year - the average duration for La Nina events based on the 10 previously occurring La Nina, each having a duration in the range of 7-22 months - it seems likely that the 1999 season will be classified as a 'non-El Nino-related' (NENR) season. If true, then, greater than or equal to 2 intense hurricanes are to be expected. Based on Poisson statistics, the probability of greater than or equal to 2 events is about 77% when the season is classified as NENR, and it is about 87% when the season is classified as NENR and the 'more active' phase is in fashion; likewise, the probability of greater than or equal to 4 events is about 31% and 48%, respectively, for the two cases. Therefore, an above average rate (possibly, as many as 4 +/- 1, or higher) of intense hurricanes forming in the Atlantic basin seems a very distinct possibility during the 1999 season.
Author
Probability Theory; Statistical Analysis; Hurricanes

NASA Goddard Space Flight Center, Greenbelt, MD USA

TRMM Field Campaigns: Objectives and Status Report

Zipser, Edward I., Utah Univ., USA; Heymsfield, Gerald, NASA Goddard Space Flight Center, USA; Kummerow, Christian, NASA Goddard Space Flight Center, USA; Simpson, Joanne, NASA Goddard Space Flight Center, USA; Thiele, Otto, NASA Goddard Space Flight Center, USA; Rutledge, Steven, Colorado State Univ., USA; Dias, Maria Assuncio Silva, Sao Paulo Univ., Brazil; Houze, Robert A., Jr., Washington Univ., USA; Yuter, Sandra, Washington Univ., USA; Kakar, Ramesh, NASA, USA; 1999; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Tropical Rainfall Measuring Mission (TRMM) satellite has been sending valuable data since launch in November 1997. Some of the key goals of the joint NASA (US) and NASDA (Japan) mission are: (1) to estimate the four-dimensional diabatic heating in the tropical and subtropical atmosphere, (2) understand the role of latent heating in driving tropical and extratropical circulations, (3) obtain monthly area-averaged estimates of rainfall over the data-sparse oceans, and (4) estimate the relative contribution of convective and stratiform precipitation over different regions during different seasons. The overarching scientific objective is to understand and improve estimates of rainfall and latent heating profiles throughout the global tropics. This requires observations for fundamental understanding of cloud dynamics and microphysics, as well as for validation, testing assumptions and error estimates of cloud-resolving models, forward radiative transfer models, algorithms used to estimate rainfall statistics and vertical structure of precipitation from surface-based radar, and from satellites. Field experiments designed to contribute to this understanding have been conducted in Texas and the South China Sea in spring of 1998, Florida in summer of 1998, and interior Brazil in (boreal) winter 1999. In summer 1999, a major oceanic campaign will be based at Kwajalein Atoll. Some early results will be highlighted, noting some significant contrasts between oceanic and continental convective systems.
Author
Heat Transfer; Rain; Trmm Satellite; Tropical Regions

Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia

Variation of Total Precipitable Water in Bandung Troposphere During ENSO Period 1994 *Kondisi Total Precipitable Water Di Troposfer Bandung Pada Kejadian Enso Tahun 1994*

Rangkuti, Alzah S., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Juaeni, Ina, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; January 1999; ISSN 0126-0480; Volume 1, No. 1, pp. 1-6; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A knowledge of the horizontal and vertical water vapor distributions is importance in the prediction of clouds, precipitation, visibility and the other weather parameters. There are some methods to evaluate the content of water vapor in the atmosphere, one's is to calculate total precipitable water as used in this research. The objective of the research is to compare the variation of water vapor content (Total Precipitable Water) on Bandung troposphere during (El Nino Southern Oscillation) ENSO period (1994) and post ENSO period (1995). Calculation of Total Precipitable Water (TPW) in 1994 and 1995 shows the fluctuation is

almost same. TPW is increase in the early and the end of year, and decrease in the mid of year. If it was correlated with ENSO event, it was found that in 1994 (ENSO period) was drier than in 1995 (post ENSO period), specially on Jun - November . The comparison between total precipitable water and relative humidity alterations shows indication of water vapor supply from other region (Jawa Sea or Hindia Ocean) and more dominant in the upper troposphere.

Author

Troposphere; Precipitation (Meteorology); Variations; Water Vapor; Southern Oscillation; El Nino

19990102887 NASA Goddard Space Flight Center, Greenbelt, MD USA

TRMM-based Merged Data Products Compared to Global Precipitation Climatology Project (GPCP) Analyses

Adler, Robert F., NASA Goddard Space Flight Center, USA; Huffman, George J., NASA Goddard Space Flight Center, USA; Bolvin, David, NASA Goddard Space Flight Center, USA; Curtis, Scott, NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper describes recent results of using Tropical Rainfall Measuring Mission (TRMM) (launched in November 1997) information as the key calibration tool; in a merged analysis on a 1 degree x l degree latitude/longitude monthly scale based on multiple satellite sources and raingauge analyses. The TRMM-based product will be compared with the community-based Global Precipitation Climatology Project (GPCP) results. The long-term GPCP analysis is compared to the new TRMM-based analysis which uses the most accurate TRMM information to calibrate the estimates from the Special Sensor Microwave/Imager (SSM/I) and geosynchronous IR observations and merges those estimates together with the TRMM and gauge information to produce accurate rainfall estimates with the increased sampling provided by the combined satellite information. The comparison with TRMM results on a month-to-month basis should clarify the strengths and weaknesses of the long-term GPCP product in the tropics and point to how to improve the monitoring analysis. Preliminary results from the TRMM merged satellite analysis indicates close agreement with the GPCP estimates. by the time of the meeting over a year of TRMM products will be available for comparison. Global tropical and regional values will be compared. Seasonal variations, and variations associated with the 1998 El Nino/ Southern Oscillation ENSO event will be examined and compared between the two analyses. These variations will be examined carefully and validated where possible from surface-based radar and gauge observations. The role of TRMM observations in the refinement of the long-term monitoring product will be outlined.

Author

Annual Variations; Calibrating; Climatology; Infrared Astronomy; Measuring Instruments; Microwave Imagery; Precipitation (Meteorology); Rain Gages; Trmm Satellite; Tropical Regions

19990102891 NASA Goddard Space Flight Center, Greenbelt, MD USA

Typical and Unusual Properties of Magnetic Clouds during the WIND Era

Lepping, R. P., NASA Goddard Space Flight Center, USA; Berdichevsky, D., NASA Goddard Space Flight Center, USA; Szabo, A., NASA Goddard Space Flight Center, USA; Burlaga, L. F., NASA Goddard Space Flight Center, USA; Thompson, B. J., NASA Goddard Space Flight Center, USA; Mariani, F., Massachusetts Inst. of Tech., USA; Lazarus, A. J., Massachusetts Inst. of Tech., USA; Steinberg, J. T., Massachusetts Inst. of Tech., USA; 1999; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A list of 33 magnetic clouds as identified in WIND magnetic field and plasma data has been compiled. The intervals for these events are provided as part of NASA/GSFC, WIND-MFI's Website under the URL http://lepmfi.qsfc.nasa.gov/mfi/mag_cloud publ.html#table The period covered in this study is from early 1995 to November 1998 which primarily occurs in the quiet part of the solar cycle. A force free, cylindrically symmetric, magnetic field model has been applied to the field data in 1-hour averaged form for all of these events (except one small event where 10 min avg's were used) and the resulting fit-parameters examined. Each event was provided a semi-quantitatively determined quality factor (excellent, good or poor). A set of 28 good or better cases, spanning a surprisingly large range of values for its various properties, was used for further analysis. These properties are, for example, durations, attitudes, sizes, asymmetries, axial field strengths, speeds, and relative impact parameters. They will be displayed and analyzed, along with some related derived quantities, with emphasis on typical vs unusual properties and on the magnetic fields magnetic clouds' relationships to the Sun and to upstream interplanetary shocks, where possible. For example, it is remarkable how narrowly distributed the speeds of these clouds are, and the overall average speed (390 techniques km/s) is less than that normally quoted for the average solar wind speed (420 km/s) despite the fact that many of these clouds are d"drivers" of interplanetary shocks. On average, a cloud appears to be a little less symmetric when the spacecraft is able to pass close to the cloud's axis as compared to a farther out passage. The average longitude and latitude (in GSE) of the axes of the clouds are 85 degrees and 8 degrees, respectively, with standard deviations near 40 degrees. Also, the half=yearly averaged axial magnetic flux has approximately tripled. almost monotonically, from about 6 to 17 X 10(exp 29) Mx over the first 3.5 years of consideration,

but with a large uncertainty on each of the half-year estimates, because of small sampling. If true,this finding implies an approximate tripling of the events' solar fluxes over this period as it goes into solar maximum.
Author

Magnetic Clouds; Magnetic Fields; Magnetic Flux; Solar Activity Effects; Solar Wind; Solar Planetary Interactions; Solar Corona

19990102921 NASA Goddard Space Flight Center, Greenbelt, MD USA

Effects of Precipitation on Ocean Mixed-Layer Temperature and Salinity as Simulated in a 2-D Coupled Ocean-Cloud Resolving Atmosphere Model

Li, Xiaofan, SM and A Corp., USA; Sui, C.–H., NASA Goddard Space Flight Center, USA; Lau, K–M., NASA Goddard Space Flight Center, USA; Adamec, D., NASA Goddard Space Flight Center, USA; September 1999; 39p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A two-dimensional coupled ocean-cloud resolving atmosphere model is used to investigate possible roles of convective scale ocean disturbances induced by atmospheric precipitation on ocean mixed-layer heat and salt budgets. The model couples a cloud resolving model with an embedded mixed layer-ocean circulation model. Five experiment are performed under imposed large-scale atmospheric forcing in terms of vertical velocity derived from the TOGA COARE observations during a selected seven-day period. The dominant variability of mixed-layer temperature and salinity are simulated by the coupled model with imposed large-scale forcing. The mixed-layer temperatures in the coupled experiments with 1-D and 2-D ocean models show similar variations when salinity effects are not included. When salinity effects are included, however, differences in the domain-mean mixed-layer salinity and temperature between coupled experiments with 1-D and 2-D ocean models could be as large as 0.3 PSU and 0.4 C respectively. Without fresh water effects, the nocturnal heat loss over ocean surface causes deep mixed layers and weak cooling rates so that the nocturnal mixed-layer temperatures tend to be horizontally-uniform. The fresh water flux, however, causes shallow mixed layers over convective areas while the nocturnal heat loss causes deep mixed layer over convection-free areas so that the mixed-layer temperatures have large horizontal fluctuations. Furthermore, fresh water flux exhibits larger spatial fluctuations than surface heat flux because heavy rainfall occurs over convective areas embedded in broad non-convective or clear areas, whereas diurnal signals over whole model areas yield high spatial correlation of surface heat flux. As a result, mixed-layer salinities contribute more to the density differences than do mixed-layer temperatures.
Author

Air Water Interactions; Atmospheric Models; Ocean Models; Clouds (Meteorology); Precipitation (Meteorology); Convection; Cooling; Salinity

19990102922 NASA Goddard Space Flight Center, Greenbelt, MD USA

Mesoscale Simulations of a Florida Sea Breeze Using the PLACE Land Surface Model Coupled to a 1.5-Order Turbulence Parameterization

Lynn, Barry H., Columbia Univ., USA; Stauffer, David R., Pennsylvania State Univ., USA; Wetzel, Peter J., NASA Goddard Space Flight Center, USA; Tao, Wei–Kuo, NASA Goddard Space Flight Center, USA; Perlin, Natal, Tel-Aviv Univ., Ramat-Aviv, Israel; Baker, R. David, Universities Space Research Association, USA; Munoz, Ricardo, Pennsylvania State Univ., USA; Boone, Aaron, Science Systems and Applications, Inc., USA; Jia, Yiqin, Science Systems and Applications, Inc., USA; Sep. 03, 1999; 45p; In English; Original contains color illustrations
Contract(s)/Grant(s): NCC5-82; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A sophisticated land-surface model, PLACE, the Parameterization for Land Atmospheric Convective Exchange, has been coupled to a 1.5-order turbulent kinetic energy (TKE) turbulence sub-model. Both have been incorporated into the Penn State/National Center for Atmospheric Research (PSU/NCAR) mesoscale model MM5. Such model improvements should have their greatest effect in conditions where surface contrasts dominate over dynamic processes, such as the simulation of warm-season, convective events. A validation study used the newly coupled model, MM5 TKE-PLACE, to simulate the evolution of Florida sea-breeze moist convection during the Convection and Precipitation Electrification Experiment (CaPE). Overall, eight simulations tested the sensitivity of the MM5 model to combinations of the new and default model physics, and initialization of soil moisture and temperature. The TKE-PLACE model produced more realistic surface sensible heat flux, lower biases for surface variables, more realistic rainfall, and cloud cover than the default model. of the 8 simulations with different factors (i.e., model physics or initialization), TKE-PLACE compared very well when each simulation was ranked in terms of biases of the surface variables and rainfall, and percent and root mean square of cloud cover. A factor separation analysis showed that a successful simulation required the inclusion of a multi-layered, land surface soil vegetation model, realistic initial soil moisture, and higher order

closure of the planetary boundary layer (PBL). These were needed to realistically model the effect of individual, joint, and synergistic contributions from the land surface and PBL on the CAPE sea-breeze, Lake Okeechobee lake breeze, and moist convection.
Author

Atmospheric Chemistry; Atmospheric Circulation; Atmospheric Models; Convection; Cloud Cover; Mesoscale Phenomena; Planetary Boundary Layer; Turbulence Models

19990102946 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Importance of Meteorological Measurement for the Scientific Study of the Mesosphere
Schmidlin, F. J., NASA Wallops Flight Facility, USA; Goldberg, R. A., NASA Goddard Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The rocket-borne falling sphere technique has been providing temperature and wind measurements to 90 km. For example, the High Resolution Doppler Imager (HRDI) experiment on the Upper Atmosphere Research Satellite (UARS) and during the GUARA Campaign. The measurement of temperature and wind using the falling sphere method is well known, but will be briefly reviewed. The vertical resolution of the data is examined at different geographical locations and seasons. Time/height sections characterizing the temperature and wind structure will be presented for low (Alcantara, Brazil), middle (Wallops Island and Barking Sands, Hawaii), and high latitudes (ARR and ESRANGE). We address radar quality required, data smoothing, and expected measurement accuracy. Special emphasis will be given to the data gathered during the GUARA campaign, especially small- and large-scale motions including transports of momentum and heat. In the GUARA campaign, the combined Use of small meteorological payloads to measure large scale temperature and wind variations coupled with measurements of small scale turbulence from the larger rockets provided clear cut evidence of gravity wave breaking in the 85 to 90 km region.
Author

Atmospheric Temperature; Falling Spheres; Meteorological Parameters; Temperature Measurement; Upper Atmosphere Research Satellite (UARS); Wind (Meteorology); Momentum Transfer; Heat Transfer; Mesosphere

19990102947 Sao Paulo Univ., Dept. of Atmospheric Sciences, Brazil
An Intercomparison Between Radar Reflectivity and the IR Cloud Classification Technique for the TOGA-COARE Area
Carvalho, L. M. V., Sao Paulo Univ., Brazil; Rickenbach, T., Maryland Univ. Baltimore County, USA; 1999; 1p; In English, 31 May - 4 Jun. 1999, Boston, MA, USA; Sponsored by American Geophysical Union, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Satellite infrared (IR) and visible (VIS) images from the Tropical Ocean Global Atmosphere - Coupled Ocean Atmosphere Response Experiment (TOGA-COARE) experiment are investigated through the use of Clustering Analysis. The clusters are obtained from the values of IR and VIS counts and the local variance for both channels. The clustering procedure is based on the standardized histogram of each variable obtained from 179 pairs of images. A new approach to classify high clouds using only IR and the clustering technique is proposed. This method allows the separation of the enhanced convection in two main classes: convective tops, more closely related to the most active core of the storm, and convective systems, which produce regions of merged, thick anvil clouds. The resulting classification of different portions of cloudiness is compared to the radar reflectivity field for intensive events. Convective Systems and Convective Tops are followed during their life cycle using the IR clustering method. The areal coverage of precipitation and features related to convective and stratiform rain is obtained from the radar for each stage of the evolving Mesoscale Convective Systems (MCS). In order to compare the IR clustering method with a simple threshold technique, two IR thresholds (Tir) were used to identify different portions of cloudiness, Tir=240K which roughly defines the extent of all cloudiness associated with the MCS, and Tir=220K which indicates the presence of deep convection. It is shown that the IR clustering technique can be used as a simple alternative to identify the actual portion of convective and stratiform rainfall.
Author
Classifications; Cloud Cover; Convection; Reflectance; Cluster Analysis

19990103004 Communications Research Lab., Ministry of Posts and Telecommunications, Kashima, Japan
Error Analysis of Rain Echo Power of Spaceborne Radar Measurements
Ohsaki, Yuji, Communications Research Lab., Japan; Ihara, Toshio, Communications Research Lab., Japan; Kozu, Toshiaki, National Space Development Agency, Japan; Journal of the Communications Research Laboratory; Nov. 1993; ISSN 0914-9260; Volume 40, No. 3, pp. 153-169; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Tropical Rainfall Measuring Mission (TRMM) radar measures rain echo from space. The signal-to-noise ratio (SNR) and the number of independent samples (N) used for averaging are the two major factors which determine the accuracy of the rain echo power measurement. The rain radar does not directly measure the rain echo power, instead, it measures the total received

power, which is the sum of the rain echo power and the receiver noise power. The rain echo power is derived by taking the difference between the total received power and the receiver noise power. Experimentally obtained total received power and receiver noise power values always have some errors. Thus, the rain echo power is sometimes estimated as a negative value when the SNR is small. The rainfall rate cannot be estimated from this value of negative rain echo power. This paper inn,cstigates the error in the rain echo power measurement for various SNR and N values assumed for TRMM radar operation. When SNR is less than -5 dB, the rain echo power is sometimes estimated as a negative value using even maximum N values. The rainfall rate measurement is possible at SNR values over -5 dB.

Author

Error Analysis; Rain; Echo Sounding; Meteorological Radar; Radar Measurement

19990103104 NASA Marshall Space Flight Center, Huntsville, AL USA

Statistical Aspects of Intense Hurricanes in the Atlantic Basin during the Past 49 Hurricane Seasons (1950-1998): Implications for the Current Season

Wilson, Robert M., NASA Marshall Space Flight Center, USA; 1999; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Statistical aspects of intense hurricanes (those of category 3 or higher) in the Atlantic basin during the interval of 1950-1998 are investigated in relation to the ENSO cycle and to the postulated 'more versus less' activity modes for intense hurricane activity. Because the 1999 hurricane season likely will be classified as a 'non-El Nino-related' (NENR) season and that the more active mode appears to be in vogue, an above average seasonal rate of greater than or equal to 2 intense hurricanes is to be expected (probably, about 4 +/- 1, or higher). Based on Poisson statistics, when the hurricane season is classified as NENR the probability of greater than or equal to 2 events is about 77%, whereas when the season is classified as NENR and the more active mode is operative it is about 87%. The probability of greater than or equal to 4 events is about 31 % and 48 %, respectively, for these two activity classes.

Author

Probability Theory; Hurricanes; Statistical Analysis

19990103144 NASA Marshall Space Flight Center, Huntsville, AL USA

On the Long-Term Trend of Atlantic Basin Intense Hurricanes

Wilson, Robert M., NASA Marshall Space Flight Center, USA; July 1998; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

During the interval of 1944-1997, 120 intense hurricanes were observed in the Atlantic basin, having an annual frequency of 0-7 events per year, being more active prior to the mid 1960s than thereafter, and being preferentially lower during El Nino years as compared to non-El Nino years. Because decadal averages of the frequency of intense hurricanes closely resemble those of average temperature anomalies for northern hemispheric and global standards and of the average temperature at the Armagh Observatory (Northern Ireland), a proxy for climatic change, it is inferred that the long-term trends of the annual frequency of intense hurricanes and temperature are statistically related. Indeed, on the basis of the 4- and 10-yr moving averages, the two are found to be strongly associated (when temperature leads by 6 yr). Because the long-term leading trends of temperature are now upward, beginning about the mid 1980s, it is inferred that the long-term trends of the annual frequency of intense hurricanes should now also be upward, beginning near 1990, suggesting that a return to the more active state probably has already occurred.

Author

Hurricanes; Periodic Variations; Data Correlation; Temperature Dependence; Trends

19990103159 NASA Marshall Space Flight Center, Huntsville, AL USA

Calculation of the Bulk Electromagnetic Properties of Thunderclouds Using a Two-Space Scattering Formalism

Phanord, Dieudonne D., Wisconsin Univ., USA; Koshak, William J., NASA Marshall Space Flight Center, USA; Solakiewicz, Richard J., Chicago State Univ., USA; Blakeslee, Richard J., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A two-space scatterer formalism and equivalent medium approach of Twersky are used to obtain formulae for the bulk electromagnetic parameters of a thundercloud medium that is illuminated by lightning optical emissions. A modified WKB approximation is applied to derive the two-space scattering amplitude. Optical constants of dry air, moist atmosphere, and water,.are inserted into the formulae to generate numerical values via iteration. The two-space scatterer formalism results are close to those obtained from free- or sin-le-space formalisms for the dilute case. The numerical values of the bulk parameters are required to

successfully transform the scattering problem to that of an equivalent obstacle excited by an incident wave traveling in K - space but radiating in k(sub 1) -space.

Author

Computation; Electromagnetic Properties; Thunderstorms; Cumulonimbus Clouds

19990103601 NASA Goddard Space Flight Center, Greenbelt, MD USA

Cloud Spatial Structure and 3D Radiative Transfer

Cahalan, Robert F., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 18-31 Jul. 1999, Unknown; Sponsored by International Union of Geodesy and Geophysics; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Cloud radiative properties are sensitive to drop size and other parameters of cloud micro-structure, but also to cloud shape,spacing, and other parameters of cloud macro-structure, including internal fractal structure. New information on cloud structure is being derived from a variety of cloud radars. Ongoing field programs such as Department of Energy's Atmospheric Radiation Measurement (DoE/ARM) are improving the measurement and modelling of physical and radiative properties of clouds. A parallel effort is underway to improve cloud remote sensing, especially from the new suite of EOS-AM1 instruments which will provide higher spectral, spatial resolution, and/or angular resolution. Key parameters for improving pixel-scale retrievals are cloud thickness and photon mean-free-path, which together determine the scale of "radiative smoothing" of cloud fluxes and radiances. This scale has been observed as a change in the spatial spectrum of LANDSAT cloud radiances, and was also recently found with the Goddard micropulse lidar, by searching for returns from directions nonparallel to the incident beam. "Off-beam" Lidar returns are now being used to estimate the cloud "radiative Green's function", G,which depends on cloud thickness and may be used to retrieve that important quantity. G is also being applied to improving simple IPA estimates of cloud radiative properties. This and other measurements of 3D transfer in clouds, coupled with Monte Carlo and other 3D transfer methods, are beginning to provide a better understanding of the dependence of adiation on cloud inhomogeneity, and to suggest new retrieval and parameterization algorithms which take account of cloud inhomogeneity. An international "Intercomparison of 3D Radiation Codes" or I3RC, program is beginning to coordinate and evaluate the variety of 3D radiative transfer methods now available, and to make them more widely available. Information is on the Web at: http://climate.qsfc.nasa.crov/I3RC. Input consists of selected cloud fields derived from data sources such as radar, microwave and satellite, and from models involved in the GEWEX Cloud Systems Studies. Output is selected radiative quantities that characterize the large- scale properties of the fields of radiative fluxes and heating. Several example cloud fields will be used to illustrate.

Author

Atmospheric Radiation; Cloud Cover; Cloud Physics; Radiative Transfer; Clouds (Meteorology); Atmospheric Correction; Atmospheric Effects

19990103608 NASA Goddard Space Flight Center, Greenbelt, MD USA

Global Monitoring of Precipitation on Monthly and Shorter Time Scales Utilizing Low-Orbit and Geosynchronous Satellite Observations

Adler, Robert, NASA Goddard Space Flight Center, USA; Curtis, Scott, NASA Goddard Space Flight Center, USA; Huffman, George, NASA Goddard Space Flight Center, USA; Bolvin, David, NASA Goddard Space Flight Center, USA; Nelkin, Eric, NASA Goddard Space Flight Center, USA; 1999; 2p; In English, 17-30 Jun. 1999, Birmingham, UK; Sponsored by International Council of Scientific Unions; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A satellite-based system to monitor global precipitation on monthly and shorter time scales is described. The monitoring system is based primarily on the Global Precipitation Climatology Project (GPCP) global, monthly, 2.5 degree by 2.5 degree latitude-longitude product which utilizes precipitation estimates from low-orbit microwave sensors (SSM/I) and geosynchronous IR sensors and raingauge information over land. The low-orbit microwave estimates are used to adjust or correct the geosynchronous IR estimates, thereby maximizing the utility of the more physically-based microwave estimates and the finer time sampling of the geosynchronous observations. Information from raingauges is blended into the analyses over land. This globally complete, monthly product is available from January 1986 to the present, with an extension back to January 1979 underway using non-SSM/I data. The monthly GPCP merged data product described in the previous paragraph is available a few (2-4) months after the end of the month. An analysis based solely on low-orbit microwave (SSM/1) data and the Goddard Profiling (GPROF) algorithm is used to bring the global monitoring up to real time. Anomalies from climatological means are produced from both the GPCP and GPROF fields to monitor the evolution of global precipitation, including the calculation of ENSO precipitation indices for real-time (five- day running means) climate monitoring and comparison with previous ENSO anomalies. The long-term climatology of the global precipitation field and the time and space variations thereof will be discussed, including the variations associated with the 1997- 1998 ENSO. The GPCP fields will also be compared to analyses based on the recently launched Tropical Rain Measuring Mission (TRMM). On an even shorter time scale, a new daily, 1 degree x 1 degree latitude-longitude global analysis

has been developed starting in January 1997 utilizing low-orbit microwave and geosynchronous IR information using a similar method as is used to produce the monthly GPCP product. Retaining the overall small bias of the monthly product the daily product will allow greater utilization in the hydrology and other science communities.
Author

Climate; Climatology; Hydrology; Precipitation (Meteorology); Rain; Satellite Observation

19990103952 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Role of Orograph and Parallax Corrections on High Resolution Geostationary Satellite Rainfall Estimates for Flash Flood Applications

Vicente, Gilberto A., NASA Goddard Space Flight Center, USA; Davenport, Clay, National Environmental Satellite Service, USA; Scofield, Rod, National Environmental Satellite Service, USA; 1999; 1p; In English; 1999 EUMETSAT Meteorological Satellite Data User's Conference, 1999, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The current generation of geosynchronous satellites exhibits considerably improved capabilities in the area of resolution, gridding accuracy, and sampling frequency as compared to their predecessors. These improvements have made it possible to accurately observe the life cycle of small scale, short-live phenomenon like rapidly developing thunderstorms, at a very high spatial and temporal resolutions. While the gain in the improved resolution is not significant for synoptic scale cloud systems, it plays a major role on the computation of precipitation values for mesoscale and stonn scale systems. Two of the important factor on the accurate precision of precipitation from satellite imagery are the position of the cloud tops as viewed by the satellite and the influence of orographic effects on the distribution of precipitation. The first problem has to do with the fact that the accurate estimation of precipitation from data collected by a satellite in geosynchronous orbit requires the knowledge of the exact position of the cloud tops with respect to the ground below. This is not a problem when a cloud is located directly below the satellite; at large viewing angles the geographic coordinates on satellite images are dependent on cloud heights and distance from the sub-satellite point. The latitude and longitude coordinates for high convective cloud tops are displaced away from the sub-satellite point and may be shifted by as much as 20 Km from the sea level coordinates. The second problem has to do with the variations in rainfall distribution with elevation. Ground observations have shown that precipitation amounts tend to increase with height and that the slope of the hill or mountain that is facing the prevailing wind normally receives greater rainfall then do the lee slopes. The purpose of the study is to show the recent developments at the Office of Research and Applications (ORA) at the National Oceanic and Atmospheric Administration (NOAA/NESDIS) in Camp Springs, MD, USA, to adjust any satellite rainfall estimation technique and account for orographic and parallax corrections. Description and examples of the procedure applied to the current NOAA/NESDIS experimental satellite rainfall estimation technique for flash flood applications will be presented at the conference.
Author

Cap Clouds; Rain; Flood Predictions; Correction; Cloud Cover; Parallax; Synchronous Satellites; Meteorological Satellites

19990103972 National Center for Atmospheric Research, Boulder, CO USA

Five-Year Plan for Research Related to the assimilation of Meteorological Data

Schlatter, T. W.; Carr, F. H.; Langland, R. H.; Carbone, R. E.; Crook, N. A.; Apr. 1999; 54p; In English
Report No.(s): PB99-162620; NCAR/TN-443; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

Recent extreme weather events have demonstrated vividly that the nation's human and economic resources are increasingly sensitive to a wide variety of weather phenomena. Improved quantitative precipitation forecasts (QPF) are the key to reducing the loss of life and property noted in the opening paragraph. The purpose of this document is to provide the scientific rationale and justification for a five-year research plan for the assimilation of meteorological observations into numerical weather prediction models. In the broadest sense, meteorological data assimilation is partly the incorporation of atmospheric measurements into computer models that predict atmospheric behavior and partly the accommodation of such models to a set of observations. The goal of data assimilation is to produce a regular, physically consistent, four-dimensional representation of the atmosphere from a heterogeneous array of in situ and remote instruments which sample imperfectly and irregularly in space and time.
NTIS

Assimilation; Meteorological Parameters; Atmospheric Physics

19990103974 NASA Goddard Space Flight Center, Greenbelt, MD USA

The Dependence on Grid Resolution of Numerically Simulated Convective Cloud Systems Using Ice Microphysics

Braun, Scott A., NASA Goddard Space Flight Center, USA; Tao, Wei–Kuo, NASA Goddard Space Flight Center, USA; Lang, Stephen E., NASA Goddard Space Flight Center, USA; Ferrier, Bradley S., NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 18-30 Jul. 1999, Birmingham, UK; Sponsored by International Council of Scientific Unions; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Mesoscale research and forecast models are increasingly being used at horizontal resolutions of 1-8 km to simulate a variety of precipitating systems. When the model is used to simulate convective systems, it is uncertain to what extent the dynamics and microphysics of convective updrafts can be resolved with grids larger than 1 km. In this study, two- and three-dimensional versions of the Goddard Cumulus Ensemble model are used to determine the impact of horizontal grid resolution on the behavior of the simulated storms and on the characteristics of the cloud microphysical fields. It will be shown that as resolution decreases from about 1 km to greater than 3 km, there is a fairly rapid degradation of the storm structure in the form of reduced convective mass fluxes, updraft tilts, and cloud microphysics. A high-resolution simulation of hurricane outer rainbands using the MM5 mesoscale model shows also that there can be a substantial modification of the key microphysical processes that contribute to rainfall as a result of reducing the horizontal resolution.
Author
Cloud Physics; Convection; Mesometeorology; Rain; Simulation; Vertical Air Currents; Hydrology Models

19990104288 NASA Goddard Space Flight Center, Greenbelt, MD USA
Model Error Estimation for the CPTEC Eta Model
Tippett, Michael K., Centro de Previsao de Tempo e Estudos Climaticos, Brazil; daSilva, Arlindo, NASA Goddard Space Flight Center, USA; [1999]; 8p; In English
Contract(s)/Grant(s): CNPq-381737/97-7; FAPESP-1998/11952-0; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Statistical data assimilation systems require the specification of forecast and observation error statistics. Forecast error is due to model imperfections and differences between the initial condition and the actual state of the atmosphere. Practical four-dimensional variational (4D-Var) methods try to fit the forecast state to the observations and assume that the model error is negligible. Here with a number of simplifying assumption, a framework is developed for isolating the model error given the forecast error at two lead-times. Two definitions are proposed for the Talagrand ratio tau, the fraction of the forecast error due to model error rather than initial condition error. Data from the CPTEC Eta Model running operationally over South America are used to calculate forecast error statistics and lower bounds for tau.
Author
Models; Estimating; Error Analysis; Forecasting

19990104289 NASA Goddard Space Flight Center, Greenbelt, MD USA
Recent Improvements in Estimating Convective and Stratiform Rainfall in Amazonia
Negri, Andrew J., NASA Goddard Space Flight Center, USA; [1999]; 9p; In English; Regional Hydrological Processes Remote Sensing, 18-19 Feb. 1999, Bonn, Germany; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

In this paper we present results from the application of a satellite infrared (IR) technique for estimating rainfall over northern South America. Our main objectives are to examine the diurnal variability of rainfall and to investigate the relative contributions from the convective and stratiform components. We apply the technique of Anagnostou et al (1999). In simple functional form, the estimated rain area A(sub rain) may be expressed as: A(sub rain) = f(A(sub mode),T(sub mode)), where T(sub mode) is the mode temperature of a cloud defined by 253 K, and A(sub mode) is the area encompassed by T(sub mode). The technique was trained by a regression between coincident microwave estimates from the Goddard Profiling (GPROF) algorithm (Kummerow et al, 1996) applied to SSM/I data and GOES IR (11 microns) observations. The apportionment of the rainfall into convective and stratiform components is based on the microwave technique described by Anagnostou and Kummerow (1997). The convective area from this technique was regressed against an IR structure parameter (the Convective Index) defined by Anagnostou et al (1999). Finally, rainrates are assigned to the Am.de proportional to (253-temperature), with different rates for the convective and stratiform
Author
Convection; Estimating; Improvement; Rain; Amazon Region (South America); Data Acquisition; Infrared Radiation

19990104327 NASA Ames Research Center, Moffett Field, CA USA
Condensed Water in Tropical Cyclone "Oliver", 8 February 1993
Pueschel, R. F., NASA Ames Research Center, USA; Allen, D. A., NASA Ames Research Center, USA; Black, C., Black (C.), USA; Faisant, S., Sterling Software, Inc., USA; Ferry, G. V., NASA Ames Research Center, USA; Howard, S. D., Synernet Corp., USA; Livingston, J. M., SRI International Corp., USA; Redemann, J., Freie Univ., Germany; Sorenson, C. E., Sterling Software, Inc., USA; Verma, S., TMA/Norcal, USA; Atmospheric Research; 1995; ISSN 0169-8095; Volume 38, pp. 297-313; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

On February 8, 1993, the NASA DC-8 aircraft profiled from 10,000 to 37,000 feet (3.1-11.3 km) pressure altitude in a stratified section of tropical cyclone "Oliver" over the Coral Sea northeast of Australia. Size, shape and phase of cloud and precipitation particles were measured with a 2-D Greyscale probe. Cloud/precipitation particles changed from liquid to ice as soon as the freezing level was reached near 17,000 feet (5.2 km) pressure altitude. The cloud was completely glaciated at -5 C. There was no correlation between ice particle habit and ambient temperature. In the liquid phase, the precipitation-cloud drop concentration was 4.0 x 10(exp 3)/cu m, the geometric mean diameter D(sub g) = 0.5-0.7 mm, and the liquid water content 0.7-1.9 g m(exp-3). The largest particles anywhere in the cloud, dominated by fused dendrites at concentrations similar to that of raindrops (2.5 x 10(exp 3) m(exp -3)) but a higher condensed water content(5.4 g/cu m estimated) were found in the mixed phase; condensed water is removed very effectively from the mixed layer due to high settling velocities of the large mixed particles. The highest number concentration (4.9 x 10(exp 4)/cu m, smallest size (D(sub g) = 0.3-0.4 mm), largest surface area (up to 2.6 x 10 (exp 2) sq cm/cu m at 0.4- 1.0 g/cu m of condensate) existed in the ice phase at the coldest temperature (- 40 C) at 35,000 feet (10.7 km). Each cloud contained aerosol (haze particles) in addition to cloud particles. The aerosol total surface area exceeded that of the cirrus particles at the coldest temperature. Thus, aerosols must play a significant role in the upscattering of solar radiation. Light extinction (6.2/km) and backscatter (0.8/sr/km) was highest in the coldest portion of the cirrus cloud at the highest altitude.
Author

Aerosols; Cirrus Clouds; Cyclones; Ice; Raindrops; Clouds (Meteorology); Anvil Clouds; Tropical Regions; Supercooling; Atmospheric Temperature

19990105696 NASA Goddard Space Flight Center, Greenbelt, MD USA
The East Asian Jet Stream and its Climate Impact
Yang, Song, Science Applications International Corp., USA; Lau, K.–M., NASA Goddard Space Flight Center, USA; Kim, K.–M., Universities Space Research Association, USA; [1999]; 1p; In English; East Asian Climate Variations, 28-30 Jun. 1999, Taipei, Taiwan, Province of China; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In this talk, I will present results from an analysis of the winter westerly jet stream over East Asia. The variability of the jet and its teleconnection to other climate subsystems such as the Asian winter monsoon, ENSO, and tropical convection will be focused. The role of external forcing and the predictability of the jet will be assessed using models. NCEP/NCAR reanalysis data, NASA GPCP data, and results from experiments with the NASA GOES-2 general circulation model will be studied.
Author

Jet Flow; Jet Streams (Meteorology); Climate Change; Teleconnections (Meteorology); Atmospheric General Circulation Models; Asia

19990106243 NASA Marshall Space Flight Center, Huntsville, AL USA
Electro-Optic Lightning Detector
Koshak, Willliam, NASA Marshall Space Flight Center, USA; Solakiewicz, Richard, NASA Marshall Space Flight Center, USA; Journal of Applied Optics; Sep. 29, 1998; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The design, alignment, calibration, and field deployment of a solid-state lightning detector is described. The primary sensing component of the detector is a potassium dihydrogen phosphate (KDP) electro-optic crystal that is attached in series to a flat plate aluminum antenna; the antenna is exposed to the ambient thundercloud electric field. A semiconductor laser diode (lambda = 685 nm), polarizing optics, and the crystal are arranged in a Pockels cell configuration. Lightning-caused electric field changes are then related to small changes in the transmission of laser light through the optical cell. Several hundred lightning electric field change excursions were recorded during 4 thunderstorms that occurred in the summer of 1998 at the NASA Marshall Space Flight Center (MSFC) in Northern Alabama.
Author

Electro-Optics; Lightning; Detection; Solid State Devices; Design Analysis; Calibrating; Performance Tests

19990106311 NASA Goddard Space Flight Center, Greenbelt, MD USA
Improving Reanalyses Using TRMM and SSM/I-Derived Precipitation and Total Precipitable Water Observations
Hou, Arthur Y., NASA Goddard Space Flight Center, USA; Zhang, Sara Q., NASA Goddard Space Flight Center, USA; daSilva, Arlindo M., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Reanalyses, 23-27 Aug. 1999, Reading, UK; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Global reanalyses currently contain significant errors in the primary fields of the hydrological cycle such as precipitation, evaporation, moisture, and the related cloud fields, especially in the tropics. The Data Assimilation Office (DAO) at the NASA Goddard Space Flight Center has been exploring the use of rainfall and total precipitable water (TPW) observations from the Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI) and the Special Sensor Microwave/ Imager (SSM/I) instru-

ments to improve these fields in reanalyses. The DAO has developed a "1+1"D procedure to assimilate 6-hr averaged rainfall and TPW into the Goddard Earth Observing System (GEOS) Data Assimilation System (DAS). The algorithm is based on a 6-hr time integration of a column version of the GEOS DAS. The "1+1" designation refers to one spatial dimension plus one temporal dimension. The scheme minimizes the least-square differences between the satellite-retrieved rain rates and those produced by the column model over the 6-hr analysis window. The control variables are analysis increments of moisture within the Incremental Analysis Update (IAU) framework of the GEOS DAS. This 1+1D scheme, in its generalization to four dimensions, is related to the standard 4D variational assimilation but differs in its choice of the control variable. Instead of estimating the initial condition at the beginning of the assimilation cycle, it estimates the constant IAU forcing applied over a 6-hr assimilation cycle. In doing so, it imposes the forecast model as a weak constraint in a manner similar to the variational continuous assimilation techniques. We present results from an experiment in which the observed rain rate and TPW are assumed to be "perfect". They show that assimilating the TMI and SSM/I-derived surface precipitation and TPW observations improves not only the precipitation and moisture fields but also key climate parameters directly linked to convective activities such as clouds, the outgoing longwave radiation, and the large-scale circulation in the tropics. In particular, assimilating these data types reduce the state-dependent systematic errors in the assimilated products. The improved analysis also leads to a better short-range forecast, but the impact is modest compared with improvements in the time-averaged fields. These results suggest that, in the presence of biases and other errors of the forecast model, it is possible to improve the time-averaged "climate content" in the assimilated data without comparable improvements in the short-range forecast skill. Results of this experiment provide a useful benchmark for evaluating error covariance models for optimal use of these data types.

Author

Algorithms; Data Systems; Estimates; Hydrological Cycle; Rain; Weather Forecasting; Water Vapor; Tropical Regions

Validation of Surface Skin Temperature and Moisture Profiles Using Satellite Data

Wu, Man Li C., NASA Goddard Space Flight Center, USA; Schubert, Siegfried, NASA Goddard Space Flight Center, USA; Lin, Ching I., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Reanalyses, 23-27 Aug. 1999, Reading, UK; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

New validation techniques and metrics using satellite data have been developed to evaluate the quality of model-based estimates of surface skin temperature (Tg) and moisture profiles (q). The satellite data consist of clear sky outgoing long-wave radiation (CLR), broadband radiances from 8 to 12 mu (RadWn), brightness temperature centered around 10.8 mu (Tbb), and total precipitable water (TPW) from microwave radiometry. We show that CLR can be used to diagnose Tg. Furthermore, by using a combination of CLR and RadWn from CERES-TRMM measurements and TPW from SSM/I, we are able to identify errors in the moisture profile. Finally, three-hourly Tbb from the International Satellite Cloud Climatology Project can be used to evaluate the amplitude and diurnal variation of Tg. For purpose of illustration, Tg and q are evaluated from runs with an early version of the Goddard Earth Observing System Data Assimilation System (GEOS-2). It is found that, in general, Tg is too cold in the winter hemisphere and q is too wet in the upper atmosphere. In order to address these deficiencies, several improvements have been implemented into GEOS-2, including a Land-Surface-Model, a Moist Turbulence Scheme, and the assimilation of new TOVS retrievals. Preliminary results indicate positive impacts from each of these implementations.

Author

Brightness Temperature; Moisture; Surface Temperature; Upper Atmosphere; Water Vapor; Winter; Weather Forecasting; Precipitation (Meteorology)

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OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources. For related information see also 43 Earth Resources and Remote Sensing.

Estimation of Wave Parameters and Observation of Two-Dimensional Current Velocities by HF Ocean Radar

Hisaki, Yukiharu, Communications Research Lab., Japan; Journal of the Communications Research Laboratory; Nov. 1993; ISSN 0914-9260; Volume 40, No. 3, pp. 133-139; In English; No Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

An HF ocean radar is an instrument which radiates HF radio waves to the sea surface and measures various physical parameters such as ocean currents, wave height, and wave period. The Okinawa Radio Observatory of the Communications Research Laboratory developed the first Japanese HF ocean radar system in 1988. Since two radar systems are necessary to measure ocean

current vectors, a second HF ocean radar system was developed in 1991. This paper introduces examples of observation results of wave parameters and ocean currents from these HF ocean radars.
Author
Estimating; Two Dimensional Models; Waves; Ocean Currents

19990103074 Louisiana State Univ., Coastal Marine Inst., Baton Rouge, LA USA
Coastal Marine Environmental Modeling
Inoue, M.; Wiseman, W. J.; Park, D.; Dec. 1998; 166p; In English
Report No.(s): PB99-167371; OCS/MMS-98/0052; No Copyright; Avail: CASI; A02, Microfiche; A08, Hardcopy
      A two-dimensional, depth-integrated, barotropic, numerical hydrodynamic model is developed to study the circulation and mixing processes in the shallow bays characteristic of coastal Louisiana, Namely, Terrebonne/Timbalier Basin and Barataria Basin. The model was forced by observed sea level heights and winds, and calibrated against observed sea level and current meter data. Despite the microtidal environment of the northern Gulf of Mexico, tidal current were an important component of the current spectrum even during equatorial tides. Local wind forcing was also important in controlling the general flow direction in the broad open reaches of the bay system. Flushing time, estimated by a particle tracking technique was in good agreement with previous estimates derived from tidal prism modeling. Horizontal diffusivities estimated using the tracer particles were comparable to those compiled by Okubo (1974) at similar length scales. The larger diffusivity values identified appear to be due to trapping by coastline irregularities and islands. The hydrodynamic model is successfully coupled to a simple ecological model to investigate the processes responsible for a spring phytoplankton bloom in Fourleague Bay.
NTIS
Oceanography; Coasts; Marine Environments; Environment Models

19990103075 Continental Shelf Associates, Jupiter, FL USA
Ecology of Live Bottom Habitats of the Northeastern Gulf of Mexico: A Community Profile
Thompson, M. J.; Shroeder, W. W.; Phillips, N. W.; Jan. 1999; 98p; In English
Report No.(s): PB99-167355; No Copyright; Avail: CASI; A05, Hardcopy; A02, Microfiche
      This community profile summarizes what is currently known about the ecology and distribution of hard bottom communities in the northeastern Gulf of Mexico. The terms 'hard' bottom and 'live' bottom are used interchangeably in this community profile to refer to those benthic organisms that grow attached to hard substrate. In general, the northeastern Gulf of Mexico is not suitable for the development of reef-building communities due to temperature range, variable water quality, and high sediment loads. Nearshore hard bottom communities are subject to environmental conditions that support a warm temperate, 'Carolinian Province' type community similar to the eastern seaboard. Although offshore communities in deeper water are less susceptible to temperature and storm-induced sediment resuspention, they are exposed to intermittent benthic nepheloid layers. The most visually conspicuous epifauna associated with these deep water hard bottom communities are suspension feeders including stony corals, gorgonians, antipatharians, sponges, and crinoids. The offshore hard bottom communities in the southern Gulf of Mexico have some tropical afinities, but are much less diverse than their counterparts in the southern Gulf of Mexico and Caribbean.
NTIS
Ecology; Marine Biology; Mexico; Habitats; Ocean Bottom; Tropical Regions

19990103934 Louisiana State Univ., Coastal Studies Inst., Baton Rouge, LA USA
Observational Study of the Mississippi-Atchafalaya Coastal Plume *Final Report*
Murray, Stephen P., Editor; Sep. 19, 1998; 554p; In English
Contract(s)/Grant(s): C-14-35-0001-30632
Report No.(s): PB99-169773; CCS/MMS-98-0400; No Copyright; Avail: CASI; A04, Microfiche; A24, Hardcopy
      The Texas-Louisiana Shelf Physical Oceanography Program (LATEX) is supported by the Minerals Management Service of the US Dept. of the Interior. Louisiana State University is conducting Study B-Mississippi River Plume Hydrography. The first field year consisted of two cruises: April 1992 and October 1992. Hydrographic data were collected using a conductivity/Temperature/density sensor and acoustic doppler current profiler. Also, data were collected for nutrients, hypoxia, light transmission, phytoplankton, zooplankton, pollutant chemistry, and Satellite imagery. Data were also collected on a front and an estuarine plume. This report details the third year of field work and synthesizes the entire project. Conclusions are drawn for each component.
NTIS
Oceanography; Plumes; Coasts; Hydrography

NASA Goddard Inst. for Space Studies, New York, NY USA

Ocean Turbulence I: One-Point Closure Model Momentum and Heat Vertical Diffusivities

Canuto, V. M., NASA Goddard Inst. for Space Studies, USA; Howard, A., NASA Goddard Inst. for Space Studies, USA; Cheng, Y., NASA Goddard Inst. for Space Studies, USA; Dubovikov, M. S., NASA Goddard Inst. for Space Studies, USA; 1999; 59p; In English

Since the early forties, one-point turbulence closure models have been the canonical tools used to describe turbulent flows in many fields. In geophysics, Mellor and Yamada applied such models using the 1980 state-of-the art. Since then, no improvements were introduced to alleviate two major difficulties: 1) closure of the pressure correlations, which affects the correct determination of the critical Richardson number Ri(sub cr) above which turbulent mixing is no longer possible and 2) the need to express the non-local third-order moments (TOM) in terms of lower order moments rather than via the down-gradient approximation as done thus far, since the latter seriously underestimates the TOMs. Since 1) and 2) are still being dealt with adjustable parameters which weaken the credibility of the models, alternative models, not based on turbulence modeling, have been suggested. The aim of this paper is to show that new information, partly derived from the newest 2-point closure model discussed, can be used to solve these shortcomings. The new one-point closure model, which in its simplest form is algebraic and thus simple to implement, is first shown to reproduce a variety of data. Then, it is used in a Ocean-General Circulation Model (O-GCM) where it reproduces well a large variety of ocean data. While phenomenological models are specifically tuned to ocean turbulence, the present model is not. It is first tested against laboratory data on stably stratified flows and then used in an O-GCM. It is more general, more predictive and more resilient, e.g., it can incorporate phenomena like wave-breaking at the surface, salinity diffusivity, non-locality, etc. One important feature that naturally comes out of the new model is that the predicted Richardson critical value Ri(sub cr) is Ri (sub cr approx. = 1) in agreement with both Large Eddy Simulations (LES) and empirical evidence while all previous models predicted Ri (sub cr approx. = 0.2) which led to a considerable underestimate of the extent of turbulent mixing and thus to an incorrect mixed layer depth. The predicted temperature and salinity profiles (vs. depth) are presented and compared with those of the Kolmogorov-Petruvsky-Piskunuv (KPP) model and Levitus data.
Author

Ocean Models; Turbulence Models; Mathematical Models; Closure Law; Turbulent Diffusion; Richardson Number; Turbulent Mixing

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LIFE SCIENCES (GENERAL)

NASA Marshall Space Flight Center, Huntsville, AL USA

Effect of Electrical Stimulation on Beta-Adrenergic Receptor Population and Coupling Efficiency in Chicken and Rat Skeleton Muscle Cell Cultures

Young, Ronald B., NASA Marshall Space Flight Center, USA; Bridge, Kristin Y., NASA Marshall Space Flight Center, USA; Strietzel, Catherine J., NASA Marshall Space Flight Center, USA; [1999]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Expression of the beta-adrenergic receptor (bAR) and its coupling to cyclic AMP (cAMP) synthesis are important components of the signaling system that controls muscle atrophy and hypertrophy, and the goal of this study was to determine if electrical stimulation in a pattern simulating slow muscle contraction would alter the bAR response in primary cultures of avian and mammalian skeletal muscle cells. Specifically, chicken skeletal muscle cells and rat skeletal muscle cells that had been grown for seven days in culture were subjected to electrical stimulation for an additional two days at a pulse frequency of 0.5 pulses/sec and a pulse duration of 200 msec. In chicken skeletal muscle cells, the bAR population was not significantly affected by electrical stimulation; however, the ability of these cells to synthesize cyclic AMP was reduced by approximately one-half. Thus, in chicken muscle cells an enhanced level of contraction reduced the coupling efficiency of bAR for cyclic AMP production by approximately 55% compared to controls. In contrast, the bAR population in rat muscle cells was increased by approximately 25% by electrical stimulation, and the ability of these cells to synthesize cyclic AMP was also increased by almost two-fold. Thus, in rat muscle cells an enhanced level of contraction increased the coupling efficiency of bAR for cyclic AMP production by approximately 50% compared to controls. The basal levels of intracellular cyclic AMP in both rat muscle cells and chicken muscle cells were not affected by electrical stimulation.
Author

Stimulation; Adrenergics; Receptors (Physiology); Coupling; Musculoskeletal System; Cells (Biology)

19990099726 NASA Marshall Space Flight Center, Huntsville, AL USA

Computational Microbial Morphometry and NASA Astrobiology Initiatives

Noever, David A., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Pattern Formation and Developmental Biology, 20 Sep. 1998, Dundee, UK; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

From the 12 known meteorites believed to have made their way to Earth from Mars, about 20 kg (44 lbs.) of material are suitable for searching for microfossil evidence. An automated neural network trained to identify common morphologies to distinguish organic and non-organic origins for rock fossils is described. The high success rate of classification by this computerized image analysis (85% on training data) moves toward a fully-automated search technique.

Author

Classifications; Fossils; Meteorites; Microorganisms; Exobiology; Extraterrestrial Life

19990102900 Los Alamos National Lab., NM USA

Tandem metal-mediated synthesis

Baker, R. T.; Dec. 31, 1998; 7p; In English

Report No.(s): DE99-002557; LA-UR-98-3640; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

This is the final report of a one-year, Laboratory Directed Research and Development (LDRD) project at Los Alamos National Laboratory (LANL). Boronic acids RB(OH)(2) are currently of interest for applications involving molecular recognition such as amine and sugar sensors and selective transport of biomolecules. They have also been shown to be powerful enzyme inhibitors and alpha-aminoboronic acids (ABAs) are particularly selective inhibitors of serine proteases. Unfortunately, current multistep synthetic routes to the latter compounds do not allow for the incorporation of a wide variety of organic substituents R that may lead to new, more selective enzyme inhibitors. In this work the author describes several direct routes to ABAs based on metal-catalyzed addition of diboron compounds to imines and nitriles. Several other applications of diboron additions to heteroatom-containing unsaturated organics are also described.

NTIS

Synthesis (Chemistry); Biochemistry

19990103937 American Prosecutors Research Inst., National Traffic Law Center, Alexandria, VA USA

Horizontal Gaze Nystagmus: The Science and the Law. A Resource Guide for Judges, Prosecutors and Law Enforcement

Dietrich, J. J., American Prosecutors Research Inst., USA; Jul. 1999; 140p; In English

Contract(s)/Grant(s): DTNH22-92-Y-05378

Report No.(s): PB99-170417; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

Legal and law enforcement communities need to better understand that horizontal gaze nystagmus (HGN) is the most reliable and effective indicator of alcohol impairment and that ample evidence is available to prove that reliability. The challenge is in conveying the strong correlation between the HGN test and impairment to the factfinder and showing how to effectively use the available evidence to prove the HGN test's validity and reliability in court. This guide is designed especially to assist judges, prosecutors and law enforcement personnel in gaining a basic understanding of HGN, its correlation to alcohol and certain other drugs, other types of nystagmus, the HGN test's scientific validity and reliability, its admissibility in other jurisdictions, and the purposes for which it may be introduced.

NTIS

Nystagmus; Alcohols; Public Law

19990103940 NASA Marshall Space Flight Center, Huntsville, AL USA

A Novel Technique for Performing Space Based Radiation Dosimetry Using DNA-Results from GRaDEx-I and the Design of GRaDEx-II

Ritter, Joe, NASA Marshall Space Flight Center, USA; Branly, R., University of Central Florida, USA; Theodorakis, C., Texas A&M Univ., USA; Bickham, J., Texas A&M Univ., USA; Swartz, C., Texas A&M Univ., USA; Friedfeld, R., Austin State Univ., USA; Ackerman, E., Broward Community Coll., USA; Carruthers, C., Broward Community Coll., USA; DiGirolamo, A., Broward Community Coll., USA; Faranda, J., Georgia State Univ., USA; [1999]; 8p; In English, Sep. 1999, Annapolis, MD, USA; Sponsored by Shuttle Small Payload Project, USA

Contract(s)/Grant(s): NAS8-40836; SVT96-45100; RTOP 451-102; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Because of the large amounts of cosmic radiation in the space environment relative to that on earth, the effects of radiation on the physiology of astronauts is of major concern. Doses of radiation which can cause acute or chronic biological effects are to be avoided, therefore determination of the amount of radiation exposure encountered during space flight and assessment of its

impact on biological systems is critical. Quantifying the radiation dosage and damage to biological systems, especially to humans during repetitive high altitude flight and during long duration space flight is important for several reasons. Radiation can cause altered biosynthesis and long term genotoxicity resulting in cancer and birth defects etc. Radiation damage to biological systems depends in a complex way on incident radiation species and their energy spectra. Typically non-biological, i.e. film or electronic monitoring systems with narrow energy band sensitivity are used to perform dosimetry and then results are extrapolated to biological models. For this reason it may be desirable to perform radiation dosimetry by using biological molecules e.g. DNA or RNA strands as passive sensors. A lightweight genotoxicology experiment was constructed to determine the degree to which in vitro naked DNA extracted from tissues of a variety of vertebrate organisms is damaged by exposure to radiation in a space environment. The DNA is assayed by means of agarose gel electrophoresis to determine damage such as strand breakage caused by high momentum particles and photons, and base oxidation caused by free radicals. The length distribution of DNA fragments is directly correlated with the radiation dose. It is hoped that a low mass, low cost, passive biological system to determine dose response relationship (increase in strand breaks with increase in exposure) can be developed to perform radiation dosimetry in support of long duration space flight, and to predict negative effects on biological systems (e.g. astronauts and greenhouses) in space. The payload was flown in a 2.5 cubic foot Get Away Special (GAS) container through NASA's GAS program. It was subjected to the environment of the space shuttle cargo bay for the duration of the STS-91 mission (9 days). Results of the genotoxicology and radiation dosimetry experiment (GRaDEx-1) as well as the design of an improved follow on payload are presented.
Author
Deoxyribonucleic Acid; Ribonucleic Acids; Radiation Damage; Radiation Dosage; Dosimeters; Electrophoresis

19990106248 NASA Marshall Space Flight Center, Huntsville, AL USA
Variability in Beta-Adrenergic Receptor Population in Cultured Chicken Muscle Cells
Young, Ronald B, NASA Marshall Space Flight Center, USA; Bridge, Kristin Y., NASA Marshall Space Flight Center, USA; Vaughn, Jeffrey R., NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Investigations into expression of the beta-adrenergic receptor (bAR) in chicken skeletal muscle cells in culture were initiated because several beta-adrenergic receptor agonists are known to increase skeletal muscle protein deposition in avian and mammalian species. During initial attempts to study the bAR population on the surface of chicken skeletal muscle cells, we observed a high degree of variability that was later found to be the result of using different batches of horse serum in the cell culture media. The separation between total binding and nonspecific binding in cells grown in two serum samples was approximately two-fold The number of nuclei within multinucleated myotubes was not significantly different in cells grown in the two serum samples. to investigate whether these two sera had an effect on coupling efficiency between bAR population and cAMP production, the ability of these cells to synthesize cAMP was also assessed. Despite the two-fold difference in receptor population, the ability of these cells to synthesize cAMP was not significantly different. Because of the possible link between bAR population and muscle protein, we also determined if the quantity of the major skeletal muscle protein, myosin, was affected by conditions that so drastically affected the bAR population. The quantity of myosin heavy chain was not significantly different.
Author
Cells (Biology); Chickens; Culture Techniques; Sympathetic Nervous System; Muscles; Adrenergics

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AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

19990102909 Prins Maurits Lab. TNO, Rijswijk, Netherlands
Exposure of Military Personnel to Hazardous Materials from Ammunition *Final Report Blootstelling van defensiepersoneel aan schadelijke stoffen afkomstig van munitie*
vanHam, N. H. A., Prins Maurits Lab. TNO, Netherlands; Aug. 07, 1999; 21p; In Dutch
Contract(s)/Grant(s): A98/D/4FC; TNO Proj. 014.10603
Report No.(s): TD99-0155; PML-1999-A60; Copyright; Avail: Issuing Activity, Hardcopy

Munitions contain many harmful substances. During the life cycle of munitions there is a definite risk that MOD personal will be in contact with these substances. This risk is immanent during the use and the destruction of munitions in the open air. In

this case yet other dangerous substances may be formed. If necessary the infrastructure of MOD buildings should be improved. Also the consciousness of the MOD personal should be in- creased by the proper instruction of relevant working place hygiene.
Author

Ammunition; Armed Forces; Education; Exposure; Hazardous Materials; Personnel

19990104345 Institute for Human Factors TNO, Soesterberg, Netherlands

Spatial Characteristics of Vibro-Tactile Perception on the Torso *Final Report Spatiele eigenschappen van vibro-tactiele perceptie op de torso*

vanErp, J. B. F., Institute for Human Factors TNO, Netherlands; Werkhoven, P. J., Institute for Human Factors TNO, Netherlands; Jul. 09, 1999; 50p; In English

Contract(s)/Grant(s): B99-031; TNO Proj. 788.1

Report No.(s): TD99-0326; TM-99-B007; Copyright; Avail: Issuing Activity, Hardcopy

The present studies were designed to gain more insight in the spatial sensitivity of the torso for vibro-tactile stimulation. Such knowledge is of great importance for successfully developing tactile display applications. The psychophysical experiments were carried out with the TNO Human Factors Research Institute tactile display, which consists of actuators that can be placed on the body in different configurations and can be manipulated individually. In the first experiment, subjects performed two kinds of tasks: a horizontal localization task (in which the mutual location of two stimuli, separated in time, had to be judged), and an inter-val discrimination task (in which the size of two open intervals, separated in time, had to be discriminated). In both tasks, the stim-uli were presented to the dorsal side of the torso. The results indicated that the second task was very hard to perform (even when feedback was given). The localization task showed an interesting effect of locus, yielding better performance in the central dorsal area versus the lateral areas. This effect was further explored in Experiments 2, 3, and 4. In Experiment 2 it was shown that there is no sensitivity gradient from central to lateral areas on the torso, in Experiment 3 it was shown that the effect exists ventral as well as dorsal for horizontal localization, and Experiment 4 indicated that this effect of location was not present for vertical local-ization. The most plausible explanation is formulated in the 'dual pathway hypothesis', which states that comparing stimuli that use different neuronal pathways or that terminate in different hemispheres is more accurate than comparing stimuli that use the same pathway or terminate in the same hemisphere. Other interesting observations are that thresholds decrease with increasing inter-stimulus-interval, that ventral acuity is better than dorsal acuity, and that hyper acuity thresholds are as low as 0.4 cm under optimal conditions.
Author

Research; Human Factors Engineering; Display Devices; Actuators; Stimulation; Torso

19990104346 Institute for Human Factors TNO, Soesterberg, Netherlands

Modelling Motion Sickness in 3D-Space *Interim Report Drie-Dimensionale Modellering van Bewegingsziekte*

Bos, J. E., Institute for Human Factors TNO, Netherlands; May 27, 1999; 44p; In English

Contract(s)/Grant(s): A98/KM/332; TNO Proj. 789.3

Report No.(s): TD99-0046; TM-99-A040; Copyright; Avail: Issuing Activity (TNO Human Factors Research Inst., Kampweg 5, P.O. Box 23, 3769 ZG Soesterberg, The Netherlands), Hardcopy

A one dimensional vestibular based model to predict sea-sickness is extended to function in response to motions that vary in all six degrees of freedom. The theoretical considerations that should be taken into account in building this complex model are presented. First a three-dimensional framework based on the control of body posture is described, and this model is specified for passively endured motions, and elaborated further to incorporate actively controlled motions too. Then, based on the refined con-flict theory (sickness only emerges when the subjective vertical is at stake), it is described how the gravity conflict created by this model propagates to finally result in sickness. To be able to give quantitative predictions, the generation of stimuli, and an imple-mentation in Matlab's Simulink are described. The first results, however, show a malfunction of the model in case angular motions are added, of which the consequences are discussed.
Author

Motion Sickness; Sicknesses; Vestibules; Mathematical Models

19990104356 Army Research Inst. of Environmental Medicine, Natick, MA USA

Ventilatory Acclimatization in Women to High Altitude

Muza, Stephen R.; Rock, Paul B.; Fulco, Charles S.; Zumudio, Stacy; Braun, Barry; May 1999; 35p; In English

Report No.(s): AD-A364916; USARIEM-T99-8; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The purpose of this study was to test the hypotheses that women ascending to high altitude in their early luteal phase will have higher resting ventilations and accelerated ventilatory acclimatization compared to women in their follicular phase. Furthermore,

given the proportionally greater ventilation in women compared to men, we postulated that women will have higher resting ventilations and accelerated ventilatory, acclimatization compared to men at the same altitude.
DTIC
Ventilation; High Altitude; Acclimatization

19990105730 Prins Maurits Lab. TNO, Rijswijk, Netherlands

Development of a Method for Biological Dosimetry of Radiation Injury in Blood Samples Collected More Than One Hour After Exposure *Final Report*

vanderSchans, G. P., Prins Maurits Lab. TNO, Netherlands; Timmerman, A. J., Prins Maurits Lab. TNO, Netherlands; vanDijk–Knijnenburg, W. C. M., Prins Maurits Lab. TNO, Netherlands; Bruijnzeel, P. L. B., Prins Maurits Lab. TNO, Netherlands; August 1999; 61p; In English

Contract(s)/Grant(s): A96/M/429; TNO Proj. 215496155

Report No.(s): TD99-0132; PML-1999-A37; Copyright; Avail: Issuing Activity, Hardcopy

In this report the results are described of the development of immunochemical assays for the detection of persistent base damage induced by ionizing radiation and attempts to develop a method for detection of damage on the single-cell level by quantitative immunofluorescence microscopy. It appeared that radiation-induced base damage can be detected in human blood lymphocytes in a dose range of 1 - 20 Gy . During the first 4 h no significant repair was observed both with Micrococcus luteus extract as well as endonuclease III. Damage induced by UV-C is only recognized by the Micrococcus luteus extract. In conclusion, this makes base damage detection a very promising biological indicator for radiation injury at periods between 1 h and longer (at least 4 h) after exposure. Together with the earlier developed biological radiation dosimeter, methods are available to detect radiation injury in blood samples collected from radiation casualties which can be applied in the time-frame immediately after radiation exposure up to possibly one day. These methods are therefore complementary to other methods which can be applied or are producing data at a later stage.
Author
Procedures; Radiation Damage; Radiation Injuries; Ionizing Radiation

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

19990102797 Army Research Inst., Simulator Systems Research Unit, Orlando, FL USA

Training Dismounted Soldiers in Virtual Environments

Goldberg, Stephen L., Army Research Inst., USA; Knerr, Bruce W., Army Research Inst., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 437-455; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The Army has traditionally trained its combat units throuch field training exercises. However, the end of the cold war has led to a substantial reduction in military budgets. Cuts in training funds have limited the amount of field training possible. Not only are modem Army weapon systems expensive to acquire and operate, their increased range and speed, relative to their predecessors, has made many existing training facilities too small to be used for realistic field training. Political and ecological considerations have made it difficult to enlarge the training areas. On a more positive note, during the same period great strides have been made in the development of simulation technology. Particularly important to Army collective training has been the growth of computer networking technology which led to distributed interactive simulations. Beginning with SIMNET, a prototype system fielded in the 1980's, distributed simulations have allowed Army unit training to be brought indoors. The Army has realized that it can no longer rely on field training as its primary mode of training. Instead it is opting for a simulation based approach that incorporates field training but relies heavily on simulation systems to carry much of the training load.
Author
Combat; Education; Modems; Prototypes; Systems Simulation

19990104357 Electrotechnical Lab., Tsukuba, Japan

A Survey on Active Memory Systems

Nishida, Kenji, Electrotechnical Lab., Japan; Tanaka, Toshio, Electrotechnical Lab., Japan; Inayoshi, Hiroaki, Electrotechnical Lab., Japan; Circulars of the Electrotechnical Laboratory; April 1999; ISSN 0366-9106, No. 229, pp. 1-52; In Japanese; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Active memory system aims to extract the information through the relations between its own actions and responses from the environment to overcome the limitations of the traditional intelligent processing systems, such as the frame problem. to construct the active memory system, the representation of the relations becomes important. However, if the relations must be defined in advance, the active memory system would face the frame problem as the traditional AI systems did. Therefore, the active memory system must have the capability to extract the relations from its interaction with the environment and reorganize its memory autonomously. We refer to the relational association in hippocampus, which is told to have a capability to extract relations in human brain, and investigate the information coding and computation schemes on it. The word "active" in the term "active memory system" has two meanings: active information acquisition and active reorganization of its memory contents. In this report, we summarize the background of the "Active memory system", the current status of related researches, and research topics of the "active memory system". In Chapter 2, we describe the frame problem in AI field and affordance theory as a background for "Active Memory System". In chapter 3, we first summarize the visual system and visual computation theory of humans. Then, the relational association in hippocampus is described, and the current status of the researches on information processing in the models of the brain is presented. In chapter 4, the researches on information coding in the brain, spiking neuron models and attention are described as necessary technologies to build Active memory system. In chapter 5, we describe the research topics for constructing the Active memory system, such as: the representation of relations, the functional interpretation of hippocampus and information coding. In the final section, we describe the two dimensional pattern recognition system as a simple example to prove the ability of the active memory system.
Author
Memory (Computers); Surveys

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing. For related information see also 16 Space Transportation.

19990100602 Department of Energy, Office of Environmental Restoration and Waste Management, Washington, DC USA
Innovative technology summary report: Sealed-seam sack suits
Sep. 30, 1998; 25p; In English
Report No.(s): DE98-007490; DOE/EM-0377; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Sealed-seam sack suits are an improved/innovative safety and industrial hygiene technology designed to protect workers from dermal exposure to contamination. Most of these disposable, synthetic-fabric suits are more protective than cotton suits, and are also water-resistant and gas permeable. Some fabrics provide a filter to aerosols, which is important to protection against contamination, while allowing air to pass, increasing comfort level of workers. It is easier to detect body-moisture breakthrough with the disposable suits than with cotton, which is also important to protecting workers from contamination. These suits present a safe and cost-effective (6% to 17% less expensive than the baseline) alternative to traditional protective clothing. This report covers the period from October 1996 to August 1997. During that time, sealed-seam sack suits were demonstrated during daily activities under normal working conditions at the C Reactor and under environmentally controlled conditions at the Los Alamos National Laboratory (LANL).
NTIS
Seams (Joints); Seals (Stoppers); Protective Clothing

19990100652 NASA Johnson Space Center, Houston, TX USA
Lightweight Seat Lever Operation Characteristics
Rajulu, Sudhakar, Lockheed Martin Corp., USA; September 1999; 28p; In English
Contract(s)/Grant(s): NAS9-18800
Report No.(s): NASA/TP-1999-209577; NAS 1.60:209577; S-851; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In 1999, a Shuttle crew member was unable to operate the backrest lever for the lightweight seat in microgravity. It is essential that crew members can adjust this backrest lever, which is titled forward during launch and then moved backward upon reaching orbit. This adjustment is needed to cushion the crew members during an inadvertent crash landing situation. JSCs Anthropometry and Biomechanics Facility (ABF) performed an evaluation of the seat controls and provided recommendations on whether the seat lever positions and operations should be modified. The original Shuttle seats were replaced with new lightweight seats whose controls were moved, with one control at the front and the other at the back. The ABF designed a 12-person experiment to investi-

gate the amount of pull force exerted by suited subjects, when controls were placed in the front and back of the lightweight seat. Each subject was asked to perform the pull test at least three times for each combination of lever position and suit pressure conditions. The results showed that, in general, the subjects were able to pull on the lever at the back position with only about half the amount of force that they were able to exert on the lever at the front position. In addition, the results also showed that subjects wearing the pressurized suit were unable to reach the seat lever when it was located at the back. The pull forces on the front lever diminished about 50% when subjects wore pressurized suits. Based on these results from this study, it was recommended that the levers should not be located in the back position. Further investigation is needed to determine whether the levers at the front of the seat could be modified or adjusted to increase the leverage for crew members wearing pressurized launch/escape suits.
Author

Spacecraft Cabins; Spacecraft Equipment; Levers; Seats

19990102416 NASA Marshall Space Flight Center, Huntsville, AL USA

Conversion of IVA Human Computer Model to EVA Use and Evaluation and Comparison of the Result to Existing EVA Models

Hamilton, George S., NASA Marshall Space Flight Center, USA; Williams, Jermaine C., Texas Univ., USA; 1998; In English; URC-TC 1998, 22-26 Feb. 1998, Huntsville, AL, USA; Sponsored by NASA Marshall Space Flight Center, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

This paper describes the methods, rationale, and comparative results of the conversion of an intravehicular (IVA) 3D human computer model (HCM) to extravehicular (EVA) use and compares the converted model to an existing model on another computer platform. The task of accurately modeling a spacesuited human figure in software is daunting: the suit restricts the human's joint range of motion (ROM) and does not have joints collocated with human joints. The modeling of the variety of materials needed to construct a space suit (e. g. metal bearings, rigid fiberglass torso, flexible cloth limbs and rubber coated gloves) attached to a human figure is currently out of reach of desktop computer hardware and software. Therefore a simplified approach was taken. The HCM's body parts were enlarged and the joint ROM was restricted to match the existing spacesuit model. This basic approach could be used to model other restrictive environments in industry such as chemical or fire protective clothing. In summary, the approach provides a moderate fidelity, usable tool which will run on current notebook computers.
Author

Computerized Simulation; Motion Simulation; Motion Simulators; Computer Aided Design; Computer Animation; Three Dimensional Models

19990102796 Lockheed Martin Missiles and Space, Advanced Technology Center, Palo Alto, CA USA

Human-Systems Interaction for Immersed Training

Stiles, Randy, Lockheed Martin Missiles and Space, USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 413-436; In English; See also 19990102782

Contract(s)/Grant(s): N00014-95-C-0179; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Human-systems interaction is the means by which a human interacts with computing and other hardware systems to accomplish tasks. Included as human-systems interaction tools are multiple modes of interaction that address human senses, such as speech dialog capability, real-time visualization, haptic feedback, etc. More important to effective interaction is a design based on the planned human tasks. This presentation relates the interaction design established for our Virtual Environments for Training (VET) program, covering the classes of interaction, tradeoffs, and sets of training tasks for our VE software. The VET program, funded by the Office of Naval Research, has developed a virtual environment architecture focused on authoring, instruction for virtual environments. The VET instructional simulation, pedagogical agents, and VRML world models can be authored to provide immersive team training. The Lockheed Martin Advanced Technology Center in Palo Alto, CA is the prime contractor for VET, with USC Information Sciences Institute and USC Behavioral Technology Labs as collaborative partners.
Author

Human Performance; Human-Computer Interface; Simulation; Education

19990102913 Institute for Human Factors TNO, Soesterberg, Netherlands

Mental Workload of the TACtical CO-ordinator of the Lynx Helicopter *Final Report Mentale Werkbelasting van de TACtical CO-ordinator van de Lynx Helikopter*

Veltman, J. A., Institute for Human Factors TNO, Netherlands; Gaillard, A. W. K., Institute for Human Factors TNO, Netherlands; May 11, 1999; 29p; In Dutch

Contract(s)/Grant(s): TNO Proj. 788.2; A96/KM/327

Report No.(s): TD-99-0042; TNO-TM-99-A036; Copyright; Avail: Issuing Activity, Hardcopy

Within a few years the Lynx helicopter will be replaced probably by the NH90. Especially the TActical CO-ordinator (TACCO) has to perform more tasks, while the present level of workload is already high. Therefore, it is important to have information about the causes of high workload. Furthermore, it is important to have reliable estimates of the workload in the future situation in order to take these into account in the choice of the future crew concept. The present study explores the factors that are related to the workload. Furthermore, the possibility to predict the workload in future systems, based upon number of tasks to be performed is explored. Five Lynx crews performed an anti submarine warfare (ASW) mission in the full mission Lynx simulator. The workload of the TACCO was measured objectively by means of the heart rate during the mission. The mission was recorded on video tape which was replayed after the mission. The crew members (pilot, TACCO and sensor operator) indicated the beginning and ending of each task and estimated the level of workload for each minute of the mission. The heart rate and subjective workload scores showed that the attack during the ASW mission was the most demanding segment of the mission. Future research on TACCO workload should be concentrated on this mission segment. Correlations between the number of tasks that were executed concurrently and the level of workload were low for the TACCO and the pilot, indicating that a prediction of workload based on the number of tasks is not reliable. The correlation was reasonably high for the sensor operator indicating that the prediction of workload based upon number of tasks is justified for the sensor operator. The situational awareness (SA) appeared to be a more important factor for the level of workload for the TACCO than the number of tasks. The workload will be acceptable as long as new information corresponds to his SA. However, when new information deviates from his SA or when information has a high level of uncertainty, the TACCO has to concentrate on this information, resulting in a high level of workload. to establish the workload of the TACCO in a future system, information about the easiness to build up SA is more important than the number of tasks to be performed.
Author

Workloads (Psychophysiology); Simulators; Mental Performance; Helicopters

19990102984 Institute for Human Factors TNO, Soesterberg, Netherlands

Wireless Communications Earplugs for use in Noisy Aircraft *Final Report Wireless Communication Earplugs voor gebruik in vliegtuigen met hoge geluidsniveaus*

vanWijngaarden, S. J., Institute for Human Factors TNO, Netherlands; Agterhuis, E., Institute for Human Factors TNO, Netherlands; Mar. 25, 1999; 46p; In English

Contract(s)/Grant(s): A98/KLu/313; TNO Proj. 786.4

Report No.(s): TD-99-0027; TM-99-A024; Copyright; Avail: Issuing Activity, Hardcopy

Upon assignment of the Royal Netherlands Air Force, the feasibility of a wireless Communications EarPlugs (CEP) was investigated. This is a type of earplugs with an integrated miniature earphone, to be used in combination with a helmet, that receives the intercom signal without wires between helmet and earplugs. A laboratory model of a wireless CEP system was developed. The wireless CEP uses signal transmission through amplitude modulation JAM). A sine carrier at a frequency of approximately 90 kHz is used, keeping the transmission outside regular RF communication bands. Applicable electromagnetic compatibility (EMC) requirements are (nearly) met by the laboratory model; with due effort a production version of the wireless CEP is expected to comply with the applicable standards. Informal measurements indicate that the magnetic fields generated by the laboratory test model are not very high in comparison to advised health limits. to fully comply with advised exposure limits, a reduction of the magnetic emission is necessary. It is expected that this may be reached by improving the sensitivity of the receiver. If further development of the wireless CEP is pursued, it is advised that this aspect is investigated more thoroughly by qualified experts in the field of EM fields and human health. Speech intelligibility performance, measured using the objective STI-method, is found to be adequate for good communication quality. Sound attenuation, measured using a subjective sound attenuation measurement method, is considerably improved by using the wireless CEP. The conclusion is that the use of a wireless CEP system in noisy aircraft is in principle a good and feasible solution for noise exposure and speech intelligibility problems.
Author

Wireless Communication; Earphones; Feasibility Analysis; Miniaturization; Electromagnetic Compatibility

19990103081 NASA Johnson Space Center, Houston, TX USA

Multimodal Preception and Multicriterion Control of Nested Systems, 3, A Functional Visual Assessment Test for Human Health Maintenance and Countermeasure Evaluation

Riccio, Gary E., Nascent Technologies Ltd., USA; McDonald, P. Vernon, Nascent Technologies Ltd., USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; September 1999; 36p; In English

Report No.(s): NASA/TP-1999-3703; S-835; NAS 1.60:3703; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Our theoretical and empirical research on the whole-body coordination during locomotion led to a Phase 1 SBIR grant from NASA JSC. The purpose of the SBIR grant was to design an innovative system for evaluating eye-head-trunk coordination during

whole-body perturbations that are characteristic of locomotion. The approach we used to satisfy the Phase 1 objectives was based on a structured methodology for the development of human-systems technology. Accordingly the project was broken down into a number of tasks and subtasks. In sequence, the major tasks were: (1) identify needs for functional assessment of visual acuity under conditions involving whole-body perturbation within the NASA Space Medical Monitoring and Countermeasures (SMMaC) program and in other related markets; (2) analyze the needs into the causes and symptoms of impaired visual acuity under conditions involving whole-body perturbation; (3) translate the analyzed needs into technology requirements for the Functional Visual Assessment Test (FVAT); (4) identify candidate technology solutions and implementations of FVAT; and (5) prioritize and select technology solutions. The work conducted in these tasks is described in this final volume of the series on Multimodal Perception and Multicriterion Control of Nested Systems. While prior volumes (1 and 2) in the series focus on theoretical foundations and novel data-analytic techniques, this volume addresses technology that is necessary for minimally intrusive data collection and near-real-time data analysis and display.
Author
Design Analysis; Evaluation; Signs and Symptoms; Visual Acuity; Perturbation

19990103621 Army Aeromedical Research Lab., Fort Rucker, AL USA
Concept Phase Evaluation of the Microvision, Inc. Aircrew Integrated Helmet System HGU-56P Virtual Retinal Display
Final Report
Rash, Clarence E.; Harding, Thomas H.; Martin, John S.; Beasley, Howard H.; Aug. 1999; 27p; In English
Contract(s)/Grant(s): Proj-3O162787A879
Report No.(s): AD-A367318; USAARL-99-18; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    In support of the RAH-66 Comanche, Microvision Inc., Seattle, Washington, has developed a prototype helmet mounted display based on laser diode sources. This prototype has been evaluated for optical and visual performance. Tests include: exit pupil size and shape, eye relief, field-of-view, luminance, contrast, contrast transfer function (CTF), modulation transfer function (MTF), and interpupilary distance and vertical adjustments.
DTIC
Visual Perception; Helmet Mounted Displays; Prototypes; Semiconductor Lasers

19990104064 NASA Marshall Space Flight Center, Huntsville, AL USA
Using Transom Jack in the Human Engineering Analysis of the Materials Science Research Rack-1 and Quench Module Insert
Dunn, Mariea C., Southern Univ., USA; Alves, Jeffrey R., Sigmatech, USA; Hutchinson, Sonya L., NASA Marshall Space Flight Center, USA; [1999]; 7p; In English; 1999 SouthEastern Simulation Conference (SESC '99), 6-7 Oct. 1999, Huntsville, AL, USA; Original contains color illustrations; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
    This paper describes the human engineering analysis performed on the Materials Science Research Rack-1 and Quench Module Insert (MSRR-1/QMI) using Transom Jack (Jack) software. The Jack software was used to model a virtual environment consisting of the MSRR-1/QMI hardware configuration and human figures representing the 95th percentile male and 5th percentile female. The purpose of the simulation was to assess the human interfaces in the design for their ability to meet the requirements of the Pressurized Payloads Interface Requirements Document - International Space Program, Revision C (SSP 57000). Jack was used in the evaluation because of its ability to correctly model anthropometric body measurements and the physical behavior of astronauts working in microgravity, which is referred to as the neutral body posture. The Jack model allows evaluation of crewmember interaction with hardware through task simulation including but not limited to collision avoidance behaviors, hand/eye coordination, reach path planning, and automatic grasping to part contours. Specifically, this virtual simulation depicts the human figures performing the QMI installation and check-out, sample cartridge insertion and removal, and gas bottle drawer removal. These tasks were evaluated in terms of adequate clearance in reach envelopes, adequate accessibility in work envelopes, appropriate line of sight in visual envelopes, and accommodation of full size range for male and female stature maneuverability. The results of the human engineering analysis virtual simulation indicate that most of the associated requirements of SSP 57000 were met. However, some hardware design considerations and crew procedures modifications are recommended to improve accessibility, provide an adequate work envelope, reduce awkward body posture, and eliminate permanent protrusions.
Author
Anthropometry; Body Size (Biology); Human Factors Engineering; Body Measurement (Biology); Astronauts; Males; Females

19990105636 Cornell Univ., Ithaca, NY USA

Extravehicular Activity Suit Systems Design: How to Walk, Talk, and Breathe on Mars

Second Annual HEDS-UP Forum; 1999, pp. 55-76; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

    Design parameters for a Mars Extravehicular Mobility Unit (EMU) are different from current space shuttle and past Apollo EMU designs. This report derives functional requirements for the life support, communication, and power subsystems of a Mars EMU from the HEDS reference mission and Mars surface conditions and proposes a design that satisfies all of the currently understood functional requirements for each subsystem. Design for the life support system incorporates O_2 storage, possible O_2 production, CO_2 absorption, humidity control, thermal regulation, and radiation protection. The communication system design centers on a reconfigurable wireless network virtualy retinal display, and emergency locator beacons. Portable power options are analyzed, and Direct Methanol Liquid Feed Fuel cells are selected for use in a design that satisfies the power requirements. Mass, cost, and technological readiness are considered for each system. This paper concludes with a recommended combination of subsystem designs that combine to form the primary subsystems of a Mars EMU.

Author

Extravehicular Activity; Functional Design Specifications; Support Systems; Production Management; Life Support Systems; Extravehicular Mobility Units; Design Analysis

19990105645 Texas Univ., San Antonio, TX USA

M.A.G.I.C. Mars Advanced Greenhouse Integrated Complex

Second Annual HEDS-UP Forum; 1999, pp. 227-246; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

    Human Exploration and Development of Space (HEDS) is a strategic enterprise of the National Aeronautics and Space Administration (NASA). One of the many goals of this initiative is the exploration and colonization of the planet Mars. One approach to this ambitious undertaking is to transport a minimum of resources and utilize as many Martian resources as possible, reducing the overall cost of the mission. A long duration mission, which utilizes in-situ plant growth-facilities, reduces the dependence on consumable supplies from earth. The reduced number of cargo launches required lowers the cost of the project. Additional equipment may then be shipped in place of consumables. Data obtained from growing food on Mars can be used in planning for permanent habitation of the planet. A team of undergraduate students and professors at the University of Texas at San Antonio (UTSA) has developed the Mars Advanced Greenhouse Integrated Complex (MAGIC). The project is designed to meet the requirements of the NASA reference mission. A two-phase approach is used. Phase 1 utilizes resources previously expended by NASA. Phase 2 is a conceptual design for large-scale growth of food on Mars.

Author

Supplying; Vegetation Growth; Greenhouses; Consumables (Spacecraft); Mars Missions

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MATHEMATICAL AND COMPUTER SCIENCES (GENERAL

19990100604 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Binomial moments of the distance distribution and the probability of undetected error

Barg, A.; Ashikhmin, A.; Dec. 31, 1998; 7p; In English

Report No.(s): DE98-006315; LA-UR-98-868; CONF-980463; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

    In (1) K.A.S. Abdel-Ghaffar derives a lower bound on the probability of undetected error for unrestricted codes. The proof relies implicitly on the binomial moments of the distance distribution of the code. The authors use the fact that these moments count the size of subcodes of the code to give a very simple proof of the bound in (1) by showing that it is essentially equivalent to the Singleton bound. They discuss some combinatorial connections revealed by this proof. They also discuss some improvements of this bound. Finally, they analyze asymptotics. They show that an upper bound on the undetected error exponent that corresponds to the bound of (1) improves known bounds on this function.

NTIS

Binomials; Error Analysis; Distance

19990100612 Los Alamos National Lab., NM USA

Strategies for nonobtuse boundary Delaunay triangulations

Murphy, M.; Gable, C. W.; Dec. 31, 1998; 12p; In English

Report No.(s): DE99-002547; LA-UR-98-3949; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

   Delaunay Triangulations with nonobtuse triangles at the boundaries satisfy a minimal requirement for Control Volume meshes. They motivate this quality requirement, discuss it in context with others that have been proposed, and give point placement strategies that generate the fewest or close to the fewest number of Steiner points needed to satisfy it for a particular problem instance. The advantage is that this strategy places a number of Steiner points proportional to the combinatorial size of the input rather than the local feature size, resulting in far fewer points in many cases.

NTIS

Triangulation; Triangles; Boundaries; Partial Differential Equations; Grid Generation (Mathematics)

19990100625 Los Alamos National Lab., NM USA

Impact of MCNP unresolved resonance probability-table treatment on U-233 benchmarks

Mosteller, R. D.; Dec. 31, 1999; 8p; In English

Report No.(s): DE99-002733; LA-UR-99-152; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

   Previous versions of the MCNP Monte Carlo code, up through and including MCNP4B, have not accurately modeled neutron self-shielding effects in the unresolved resonance energy region. Recently, a probability-table treatment has been incorporated into an intermediate version called MCNP4XS, and compatible continuous-energy cross-section libraries have been developed for 27 different isotopes. Preliminary results for a variety of uranium and plutonium benchmarks have been presented previously, and this paper extends those results to include several U-233 benchmarks. The objective of the current study is to assess the reactivity impact of the probability-table treatment on U-233 systems.

NTIS

Probability Theory; Reactivity

19990100626 Los Alamos National Lab., Scientific Computing Group, NM USA

Instruction-level performance modeling and characterization of multimedia applications

Luo, Y.; Cameron, K. W.; Dec. 31, 1999; 20p; In English; ICS 1999: supercomputing

Report No.(s): DE99-002730; LA-UR-99-303; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

   One of the challenges for characterizing and modeling realistic multimedia applications is the lack of access to source codes. On-chip performance counters effectively resolve this problem by monitoring run-time behaviors at the instruction-level. This paper presents a novel technique of characterizing and modeling workloads at the instruction level for realistic multimedia applications using hardware performance counters. A variety of instruction counts are collected from some multimedia applications, such as RealPlayer, GSM Vocoder, MPEG encoder/decoder, and speech synthesizer. These instruction counts can be used to form a set of abstract characteristic parameters directly related to a processor's architectural features. Based on microprocessor architectural constraints and these calculated abstract parameters, the architectural performance bottleneck for a specific application can be estimated. Meanwhile, the bottleneck estimation can provide suggestions about viable architectural/functional improvement for certain workloads. The biggest advantage of this new characterization technique is a better understanding of processor utilization efficiency and architectural bottleneck for each application. This technique also provides predictive insight of future architectural enhancements and their affect on current codes. In this paper the authors also attempt to model architectural effect on processor utilization without memory influence. They derive formulas for calculating CPI(sub 0), CPI without memory effect, and they quantify utilization of architectural parameters. These equations are architecturally diagnostic and predictive in nature. Results provide promise in code characterization, and empirical/analytical modeling.

NTIS

Mathematical Models; Characterization; Multimedia; Education; Performance Prediction

19990102878 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France

Parabolic Sheaves on Surfaces and Affine Lie Algebra g (logical and) l (sub n)

Finkelberg, M.; Kuznetsov, A.; Apr. 1999; 42p

Report No.(s): PB99-159345; IHES/M/99/17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

   The purpose of this paper is to give an example of geometric construction (via Hecke correspondences) of certain representations of the affine Lie algebra gl(sub n).

NTIS

Algebra; Geometry

19990103041 Los Alamos National Lab., NM USA
Quantum computation with 'hot' trapped ions
James, D. F. V.; Schneider, S.; Milburn, G. J.; Dec. 31, 1998; 7p; In English; Quantum communication measurement and computing conference
Report No.(s): DE99-002603; LA-UR-98-3899; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
The authors describe two methods that have been proposed to circumvent the problem of heating by external electromagnetic fields in ion trap quantum computers. Firstly the higher order modes of ion oscillation (i.e., modes other than the center-of-mass mode) have much slower heating rates, and can therefore be employed as a reliable quantum information bus. Secondly they discuss a recently proposed method combining adiabatic passage and a number-state dependent phase shift which allows quantum gates to be performed using the center-of-mass mode as the information bus, regardless of its initial state.
NTIS
Trapped Particles; Ions; Quantum Mechanics

19990103046 Los Alamos National Lab., Scientific Computing Group, NM USA
Performance analysis of large-scale applications based on wavefront algorithms
Hoisie, A.; Lubeck, O.; Wasserman, H.; Dec. 31, 1998; 7p; In English; HPCCP/CAS workshop
Report No.(s): DE99-002576; LA-UR-98-3840; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
The authors introduced a performance model for parallel, multidimensional, wavefront calculations with machine performance characterized using the LogGP framework. The model accounts for overlap in the communication and computation components. The agreement with experimental data is very good under a variety of model sizes, data partitionings, blocking strategies, and on three different parallel architectures. Using the model, the authors analyzed performance of a deterministic transport code on a hypothetical 100 flops future parallel system of interest to ASCI.
NTIS
Performance Prediction; Algorithms; Wave Fronts; Reliability Analysis

19990103051 Rutherford Appleton Lab., Computational Science and Engineering Dept., Oxford, UK
Class of Incomplete Orthogonal Factorization Methods, 1, Methods and Theories
Bai, Z. Z.; Duff, I. S.; Wathen, A. J.; Jul. 15, 1999; 30p; In English
Report No.(s): PB99-168742; RAL-TR-1999-045; Copyright; Avail: National Technical Information Service (NTIS), Hardcopy
The authors study the solution of large sparse nonsingular and unsymmetric systems of linear equations. The authors present a class of incomplete orthogonal factorization methods based on Givens rotations. These methods include: Incomplete Givens Orthogonalization (IGO-method) and Generalized Incomplete Givens Orthogonalization (GIGO-method), which drop entries from the incomplete orthogonal and upper triangular factors by position; Threshold Incomplete Givens Orthogonalization (TIGO(tau)-method), which drops entries dynamically by their magnitudes; and Generalized Threshold Incomplete Givens Orthogonalization (GTIGO(tau, rho)-method), which drops entries dynamically by both their magnitudes and positions. Theoretical analyses show that these methods can produce a nonsingular sparse nonsingular incomplete orthogonal factor for a general nonsingular matrix.
NTIS
Orthogonality; Factorization

19990103072 Rutherford Appleton Lab., Computational Science and Engineering Dept., Chilton, UK
Primal-Dual Trust-Region Algorithm for Minimizing a Non-Convex Function Subject to General Inequality and Linear Equality Constraints
Conn, A. R.; Gould, N. I. M.; Orban, D.; Toint, P. L.; Aug. 13, 1999; ISSN 1358-6254; 38p; In English
Report No.(s): PB99-168783; RAL-TR-1999-054; Copyright; Avail: National Technical Information Service (NTIS), Microfiche, Hardcopy
A new primal-duel algorithm is proposed for the minimization of non-convex objective functions subject to general inequality and linear equality constraints. The method uses a primal-dual trust-region model to ensure descent on a suitable merit function. Convergence is proved to second-order critical points from arbitrary starting points. Preliminary numerical results are presented.
NTIS
Algorithms; Inequalities

19990104341 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France

Tame Sets, Dominatin Maps, and Complex Tori

Buzzard, G. T.; Jun. 1999; 18p; In English

Report No.(s): PB99-167108; IHES/M/99/46; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

In this paper, the authors give a fairly general sufficient condition for a discrete set, Lambda, in C(sub n) to be tame; that there exists a holomorphic projection, pi, from C(sub n) to a complex line (which we may assume is the z(sub 1)-axis) such that pi(Lambda) is an Arakelian set and that the interior of pi(Lambda) has no unbounded components.

NTIS

Set Theory; Theorem Proving

19990104358 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France

Functoriality of Real Analytic Torsion Form

Ma, X.; Jan. 1999; 44p; In English

Report No.(s): PB99-148710; IHES/M/99/03; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Let pi(sub 1) : W approaches V, pi(sub 2) : V approaches S be smooth fibrations of manifolds with compact fibre. Let F be a flat complex vector bundle on W. In this paper, we prove the functoriality of the analytic torsion forms of Bismut and Lott [BLo] with respect to the composition of two submersions.

NTIS

Torsion; Fixed Points (Mathematics)

60
COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing. For components see 33 Electronics and Electrical Engineering.

19990100635 NASA Marshall Space Flight Center, Huntsville, AL USA

Development of a COTS Mass Storage Unit for the Space Readiness Coherent Lidar Experiment

Liggin, Karl, NASA Marshall Space Flight Center, USA; Clark, Porter, NASA Marshall Space Flight Center, USA; 1999; 6p; In English; 18th; Digital Avionics Systems, 23-29 Oct. 1999, Saint Louis, MO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The technology to develop a Mass Storage Unit (MSU) using commercial-off-the-shelf (COTS) hard drives is an on-going challenge to meet the Space Readiness Coherent Lidar Experiment (SPARCLE) program requirements. A conceptual view of SPARCLE's laser collecting atmospheric data from the shuttle is shown in Figure 1. The determination to develop this technology required several in depth studies before an actual COTS hard drive was selected to continue this effort. Continuing the development of the MSU can, and will, serve future NASA programs that require larger data storage and more on-board processing.

Derived from text

Data Acquisition; Data Storage; Onboard Data Processing; Optical Radar

19990102202 Department of Energy, Office of Energy Research, Washington, DC USA

Study of hard disk and slider surfaces using X-ray photoemission electron microscopy and near-edge X-ray absorption fine structure spectroscopy

Anders, S.; Stammler, T.; Bhatia, C. S.; Stoehr, J.; Fong, W.; Apr. 30, 1998; 7p; In English; Spring meeting of the Materials Research Society

Report No.(s): DE98-054171; LBNL-41064; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

X-ray Photo Emission Electron Microscopy (X-PEEM) and Near Edge X-ray Absorption Fine Structure (NEXAFS) spectroscopy were applied to study the properties of amorphous hard carbon overcoats on disks and sliders, and the properties of the lubricant. The modification of lubricants after performing thermal desorption studies was measured by NEXAFS, and the results are compared to the thermal desorption data. The study of lubricant degradation in wear tracks is described. Sliders were investigated before and after wear test, and the modification of the slider coating as well as the transfer of lubricant to the slider was studied. The studies show that the lubricant is altered chemically during the wear. Fluorine is removed and carboxyl groups are formed.

NTIS

Fine Structure; Spectroscopy; Magnetic Disks

19990103930 National Aerospace Lab., Tokyo Japan

Characteristic Parameters of the NWT Computer System in the Local Memory Access

Hatayama, S.; Oct. 1998; 30p; In English

Report No.(s): PB99-169641; TR-1361T; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The NWT computer system available at the NAL since February 1993 comprises two system administrators, n processing elements (where n was 140 at the beginning, and is 166 at present) and a crossbar network, and operates as a distributed-memory message-passing MIMD computer. Each processing element itself is a vector computer. This paper reports measurements of two pairs of the characteristic parameters, (tau (sub infinity), n (sub 1/2)) and (tau (sub infinity), s (sub 1/2)), of the NWT with SIMD computing on a single processing element and with MIMD computing in the local memory access, respectively. The significance of the obtained results is interpreted, and several hardware parameters are estimated. The results in this paper apply only to the NWT system software during the period April to June 1993 after which substantial improvement have been achieved with the NWT performance.

NTIS

Distributed Processing; Distributed Memory; Memory (Computers); Local Area Networks; Access Control

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COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, algorithms, and specific applications, e.g., CAD/CAM.

19990100641 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

The Design of Sparse Direct Solvers Using Object-Oriented Techniques *Final Report*

Dobrian, Florin, Old Dominion Univ., USA; Kumfert, Gary, Old Dominion Univ., USA; Pothen, Alex, Institute for Computer Applications in Science and Engineering, USA; Sep. 1999; 40p; In English

Contract(s)/Grant(s): NAS1-97046; NSF CCR-94-12698; NSF DMS-98-07172; RTOP 505-90-52-01

Report No.(s): NASA/CR-1999-209558; NAS 1.26:209558; ICASE-99-38; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe our experience in designing object-oriented software for sparse direct solvers. We discuss Spindle, a library of sparse, matrix ordering codes, and OBLIO, a package that implements the factorization and triangular solution steps of a direct solver. We discuss the goals of our design: managing complexity, simplicity of interface, flexibility, extensibility, safety, and efficiency. High performance is obtained by carefully implementing the computationally intensive kernels and by making several tradeoffs to balance the conflicting demands of efficiency and good software design. Some, of the missteps that we made in the course of this work are also described.

Author

Object-Oriented Programming; Software Development Tools; Applications Programs (Computers); Software Engineering; Algorithms; Computer Programming; Computer Systems Programs; Data Structures

19990100642 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Parallelization of a Multigrid Incompressible Viscous Cavity Flow Solver Using OpenMP

Roe, Kevin, Institute for Computer Applications in Science and Engineering, USA; Mehrotra, Piyush, Institute for Computer Applications in Science and Engineering, USA; September 1999; 16p; In English; 9th; SIAM Parallel Processing for Scientific Computing, USA

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-1999-209551; NAS 1.26:209551; ICASE-99-36; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe a multigrid scheme for solving the viscous incompressible driven cavity problem that has been parallelized using OpenMP. The incremental parallelization allowed by OpenMP was of great help during the parallelization process. Results show good parallel efficiencies for reasonable problem sizes on an SGI Origin 2000. Since OpenMP allowed us to specify the number of threads (and in turn processors) at runtime, we were able to improve performance when solving on smaller/coarser meshes. This was accomplished by giving each processor a more reasonable amount of work rather than having many processors work on very small segments of the data (and thereby adding significant overhead).

Author

Two Dimensional Flow; Incompressible Flow; Multigrid Methods; Viscous Flow; Cavity Flow

19990100667 Institute for Computer Applications in Science and Engineering, Hampton, VA USA

Parallel Implementation of the Discontinuous Galerkin Method *Final Report*

Baggag, Abdalkader, Institute for Computer Applications in Science and Engineering, USA; Atkins, Harold, NASA Langley Research Center, USA; Keyes, David, Institute for Computer Applications in Science and Engineering, USA; August 1999; 12p; In English

Contract(s)/Grant(s): NAS1-97046; RTOP 505-90-52-01

Report No.(s): NASA/CR-1999-209546; NAS 1.26:209546; ICASE-99-35; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper describes a parallel implementation of the discontinuous Galerkin method. Discontinuous Galerkin is a spatially compact method that retains its accuracy and robustness on non-smooth unstructured grids and is well suited for time dependent simulations. Several parallelization approaches are studied and evaluated. The most natural and symmetric of the approaches has been implemented in all object-oriented code used to simulate aeroacoustic scattering. The parallel implementation is MPI-based and has been tested on various parallel platforms such as the SGI Origin, IBM SP2, and clusters of SGI and Sun workstations. The scalability results presented for the SGI Origin show slightly superlinear speedup on a fixed-size problem due to cache effects.
Author

Galerkin Method; Linearization; Unstructured Grids (Mathematics); Time Dependence; Simulation; Euler Equations of Motion

19990100679 Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA

Buy It Prototype Testing Plan *Final Report, Jan. - Aug. 1997*

David, Janet; Aug. 1999; 103p; In English

Report No.(s): AD-A366033; ARL-MR-454; No Copyright; Avail: CASI; A02, Microfiche; A06, Hardcopy

This document is the fourth in a series of reports documenting the structured design process of BuyIt. As part of the Corporate Business Application Software System (C-BASS) suite of work flow and information management software, BuyIt automates small purchase orders for the U.S. Army Research Laboratory (ARL). The software testing plan developed in this document was derived from two antecedent documents: "BuyIt. Software Requirement Analysis" and "BuyIt. Detailed Design Report." The testing plan for BuyIt. is delineated in the five major sections of this report: (1) "Usability Testing,"; (2) "Preparing for Usability Testing,"; (3) "Alpha Testing,"; (4) "Beta Testing,"; and (5) "User Testing Plan Task List." Together, they describe an overall strategy for testing as well as delineate the test cases to be used to demonstrate that the software works according to its specifications.
DTIC

Applications Programs (Computers); Computer Systems Programs; Management Information Systems

19990102782 NASA Langley Research Center, Hampton, VA USA

Advanced Training Technologies and Learning Environments

Noor, Ahmed K., Compiler, Virginia Univ., USA; Malone, John B., Compiler, NASA Langley Research Center, USA; July 1999; 474p; In English, 9-10 Mar. 1999, Hampton, VA, USA; Sponsored by NASA, USA; See also 19990102783 through 19990102798

Contract(s)/Grant(s): RTOP 282-10-01-42

Report No.(s): NASA/CP-1999-209339; L-17860; NAS 1.55:209339; No Copyright; Avail: CASI; A20, Hardcopy; A04, Microfiche

This document contains the proceedings of the Workshop on Advanced Training Technologies and Learning Environments held at NASA Langley Research Center, Hampton, Virginia, March 9-10, 1999. The workshop was jointly sponsored by the University of Virginia's Center for Advanced Computational Technology and NASA. Workshop attendees were from NASA, other government agencies, industry, and universities. The objective of the workshop was to assess the status and effectiveness of different advanced training technologies and learning environments.
Author

Conferences; Education; Training Simulators; Effectiveness

19990102783 Houston Univ., Virtual Environment Technology Lab., TX USA

Advanced Technologies for Training and Education

Loftin, R. Bowen, Houston Univ., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 35-55; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The NASA/University of Houston Virtual Environment Technology Laboratory (VETL) was born at the NASA/Johnson Space Center in late 1990 when Robert T. Savely (Johnson Space Center's Chief Scientist for Advanced Software Technology) and I reached the conclusion that commercial off-the-shelf hardware needed to create immersive, interactive virtual environments and had reached sufficient maturity to justify an investment. It was our judgment that virtual environment technology (otherwise

known as virtual reality) had the potential to address significant NASA training needs, perhaps more cheaply than conventional techniques. Over the next two years, the development of a skilled group of software engineers and students (as applications were developed and refined) culminated, in 1993, with the creation of a series of virtual environments that were used to train over 100 members of the ground-based flight team for the Hubble Space Telescope Servicing Mission. In early 1995 the magnitude and diversity of VETL's work grew to the point where it could not be sustained in the original lab site at the Johnson Space Center. Jane Steams (Chief of the Johnson Space Center Business and Information Systems Directorate) elected to pursue a formal relationship with the University of Houston to form a joint laboratory. In May 1995, the Director of the Johnson Space Center executed a Space Act Agreement with the University of Houston that created the current VETL. The laboratory's objectives now include research and development activities in training, education and scientific/engineering data visualization.
Author
Software Engineering; Scientific Visualization; Research and Development; Training Devices; Technology Assessment; Education

19990102784 Randall House Associates, Inc., Annapolis, MD USA
The Light Speed Changes of Web-Based Distributed Learning: Technologies and Standards
Dodds, Philip V. W., Randall House Associates, Inc., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 57-81; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
    Contents include the following:Transition to web-based learning system; CMI/LMS revolution in progress; "Learning model" chaos; Proposed reference model; CM-ROM; WEB/HTML: WEB/XML/Objects; Computer management instruction model; and Web technology.
CASI
Standards; Technology Assessment; Training Analysis

19990102785 Institute for Defense Analyses, Alexandria, VA USA
Intelligent Tutoring Systems: Then and Now
Fletcher, J. Dexter, Institute for Defense Analyses, USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 83-104; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
    This talk was presented on March 10, 1999 by Dr. Dexter Fletcher who is a research staff member at the Institute for Defense Analyses (IDA) in Alexandria, Virginia. IDA's sole function is to perform studies and analyses of scientific and technical matters for the Office of the Secretary of Defense (OSD). As usual, this presentation represents the views of the presenter and does not represent official policies or positions of either IDA or OSD. The phrase Intelligent Tutoring Systems (ITS) covers a form of computer-based instruction (CBI) that has also been called intelligent computer-assisted instruction (ICAI). ITSs may be as intelligently or un-intelligently designed as any other form of CBI. 'Intelligent' in this case refers to a particular functionality that is the goal of these systems and is further defined in this discussion. Although much in this presentation may be relevant to private and public sector education, it is focused on applications of ITS to military training. The presentation is also fairly compressed. More could be said about all the issues it raises.
Author
Computer Assisted Instruction; Training Devices; Procedures; Artificial Intelligence

19990102786 Pittsburgh Univ., Learning Research and Development Center, Pittsburgh, PA USA
Intelligent Learning Environments for Technical Training: Lessons Learned
Lesgold, Alan M., Pittsburgh Univ., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 105-124; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
    At the Learning Research and Development Center, we have been at work simultaneously on both high-end intelligent training systems and on non-technological approaches to training that depend on substantial instructor time but with only a blackboard. We have begun now to bridge the gap between these technology extremes in our efforts to improve the professional skills of teachers. In addition, in work we performed a few years ago for the World Bank, we began development of "just-in- time" training and knowledge enhancement opportunities that can be triggered by clicking on icons embedded in the web-based forms that are becoming the basis for office activity in the information age. A worker using a form such as a budget sheet or a project plan template can click on the training icon to gain access to either focused coaching or an on-line library of useful training documents and records of "lessons learned"by other workers. Below, I describe how simple and relatively low cost training technology can be informed by the more expensive earlier efforts on intelligent systems for training that have been made in the U.S. and Western

Europe. I also discuss the specific skills needed by software developers to produce useful training tools and the ways in which tools can be developed incrementally, permitting government and industry sponsors to test the value of this kind of approach.
Author

Artificial Intelligence; Education; Learning; Knowledge Bases (Artificial Intelligence); Training Analysis

19990102787 Virginia Univ., Center for Advanced Computational Technology, Hampton, VA USA
Pathway to the Future of Learning
Noor, Ahmed K., Virginia Univ., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 1-43; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

The convergence of computing, communication and information technologies is reshaping relationships among researchers and organizations and dramatically changing the way we work and the way we learn. This presentation provides an overview of training technologies and learning environments. First, the goals of education and training are described. The instructional models and learning technologies appropriate for achieving different learning goals are identified. Second, a brief description is given of the evolution of learning technologies. Third, the forces driving a paradigm change in learning are identified, and the technologies that can lead to a revolutionary change in learning are listed. Fourth, different learning strategies are described along with three advanced learning environments. Finally, current government and non-government activities on advanced learning technologies and environments are listed.
Author

Training Analysis; Education; Information Management

19990102788 Air Force Research Lab., Brooks AFB, TX USA
DATAGUIDES (Deployable Agents for Training, Aiding and Guidance)
Regian, J. Wesley, Air Force Research Lab., USA; Fleming, Jim, Air Force Research Lab., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 125-170; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

This presentation utilizes Microsoft ActiveX technologies to demonstrate a new class of internet-deployable intelligent agents - called Dataguides. Dataguides are knowledge-based interactive personalities that can support users in both training and operational environments. In operational settings, Dataguides will serve as intelligent assistants that continuously learn about their performance domains as well as their primary user. This evolving user model will also serve to support refresher training and subsequent new training for users. Dataguides will support skill maintenance by alerting the users, or supervisors, when refresher training or update training is required, and then provide tailored training scenarios. This as-needed training capability will be especially useful in maintaining readiness for critical but rare situations. The combined contents of many student models within a career field will serve to drive new training and support enhancements for that career field. When plugged into an embedded training environment, Dataguides will provide the student's history to the embedded training agent, and provide training job aiding, tailored display, and decision support for the student.
Author

Computer Programs; Education; Personnel Development; Training Analysis

19990102789 National Inst. of Standards and Technology, Advanced Technology Program, Gaithersburg, MD USA
ATP and the Adaptive Learning Systems Program
Liebergot, Harris L., National Inst. of Standards and Technology, USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 171-198; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

There are four main organizations at the National Institute of Standards and Technology. The Measurements and Standards Laboratories are the technical leaders for the development and maintenance of U.S. standards and measurements. MEP operates a nationwide network of regionally based extension centers that help smaller manufacturers adopt advanced technologies and business practices. The Malcolm Baldrige National Quality Program has become both the U.S. standard of performance excellence in business and a comprehensive guide to quality improvement.
Author

Research Facilities; Organizations; Standardization

19990102790 Department of Energy, Office of Training and Human Resource Development, Washington, DC USA
Engineering a Successful Corporate Technology Supported Learning Program *Progress Report*
Luckett, Tanya, Department of Energy, USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 199-237; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche

Author share the experiences in implementing a Corporate Technology-Supported Learning program. Purpose of this briefing: Describe DOE's experience in establishing a Corporate Technology-Supported Learning (TSL) Program. Point to some, useful process/products (studies, business case, base lining study, pilots, etc.). Suggest lessons learned thus far... and Extrapolate from DOE's experience to broader technology adoption issues... Perspectives...
Derived from text
Learning; Training Analysis; Organizations

19990102791 Northwestern Univ., Inst. for the Learning Sciences, Evanston, IL USA
Experience Working with Five Architectures for Learning by Doing
Kass, Alex, Northwestern Univ., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 239-270; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
　　There is widespread agreement among educational researchers that people learn best by doing. However, the choice of learning by doing over passive absorption of information is not the end of the educational design discussion - it is really just the beginning. The next logical question is, should learners be doing? At the Institute for the Learning Sciences we have been looking at that question for several years now, and developing technology infrastructure to support several different kinds of learn-by-doing task types. We call these independent systems educational architectures. In this talk, I will discuss five of those architectures very briefly and show examples of how some of them look in action.
Author
Education; Procedures; Learning

19990102792 University of Southern California, Behavioral Technology Labs., Redondo Beach, CA USA
An Open Architecture for Simulation-Centered Tutors
Munro, Allen, University of Southern California, USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 271-318; In English; See also 19990102782
Contract(s)/Grant(s): F33615-90-C-0001; N00014-98-1-0510; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
　　Over a period of more than fifteen years, my colleagues and I have conducted a body of research on simulation centered tutoring and on authoring tools for simulation centered authoring. We have developed a number of experimental monolithic authoring applications. This presentation reports on that progress and outlines a new approach based on lighter-weight collaborating components. The presentation has three themes: Robust interactive simulations provide a context in which instructional intelligence can be consistently exploited. The authoring of both simulations and tutors is more cost effective than programming. Component-based systems offer advantages over monolithic systems, including lightweight delivery over intranets.
Author
Research; Simulation; Computer Programs; Education

19990102793 University of Southern California, Center for Advanced Research in Technology for Education, Marina del Rey, CA USA
Pedagogical Agents as Facilitators for Lifelong Learning
Johnson, W. Lewis, University of Southern California, USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 319-342; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
　　This talk was presented at the Workshop on Advanced Training Technologies and Learning Environments, NASA Langley Research Center, Hampton, VA, March 9-10, 1999. It presents some work on pedagogical agents as facilitators for lifelong learning at USC's Center for Advanced Research in Technology Education (CARTE), and explains how such agents can help make learning environments more effective at fostering lifelong learning.
Author
Education; Technologies

19990102794 University of Southern California, Behavioral Technology Labs., Saint Helena, CA USA
Generating and Delivering Diagnostic Instruction
Towne, Douglas M., University of Southern California, USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 343-367; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
　　Learning to diagnose faults in a complex system requires extensive troubleshooting practice on that system. The time and cost to gain and given level of proficiency can be dramatically reduced if practice is provided in a simulation environment along with individualized guidance. This presentation will describe an extended research and development program conducted to: 1)

facilitate the production of realistic system simulations, and 2) automatically generate intelligent troubleshooting tutoring from the simulation.
Author
Research and Development; Maintenance; Diagnosis; Fault Detection

19990102795 Fisher Group, Inc., Beaverton, OR USA
Creating a Learning Environment: Considering the Human Factors
Fisher, Kimball, Fisher Group, Inc., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 369-411; In English; See also 19990102782; No Copyright; Avail: CASI; A03, Hardcopy; A04, Microfiche
   Creating an effective learning environment requires not only technology, but an understanding of a number of other factors as well. In this presentation I will discuss why we should care about creating a learning environment, what a learning environment entails, define high performance work systems, discuss the difference between technical and human factors, identify common learning traps, talk about the importance of learning in public, and mention special learning challenges associated with virtual teams.
Derived from text
Human Factors Engineering; Education

19990103010 Unisys Corp., Software Assurance Technology Center, Greenbelt, MD USA
A Methodology for Writing High Quality Requirements Specification and Evaluating Existing Ones
Rosenberg, Linda, Unisys Corp., USA; Hammer, Theodore, NASA Goddard Space Flight Center, USA; May 1999; In English; 11th, May 1999, Salt Lake, UT, USA
Contract(s)/Grant(s): NAS5-32910; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche
   Requirements development and management have always been critical in the implementation of software systems; engineers are unable to build what analysts can't define. It is generally accepted that the earlier in the life cycle potential risks are identified the easier it is to eliminate or manage the conditions that introduce that risk. Problems that are not found until testing are approximately 14 times more costly to fix than if the problem was found in the requirement phase. The requirements specification, as the first tangible representation of the capability to be produced, establishes the basis for all of the project's engineering management and assurance functions. If the quality of the requirements specification is poor it can give rise to risks in all areas of the project. Recently, automated tools have become available to support requirements management. The use of these tools not only provides support in the definition and tracing of requirements, but it also opens the door to effective use of metrics in characterizing and assessing the quality of the requirement specifications.
Derived from text
Software Engineering; Specifications; Requirements; Computer Systems Design; Systems Engineering; Systems Analysis

19990103042 Los Alamos National Lab., NM USA
Array design and expression evaluation in POOMA II
Karmesin, S.; Crotinger, J.; Cummings, J.; Haney, S.; Humphrey, W.; Dec. 31, 1998; 9p; In English; ISCOPE 1998: international symposium on computing in object oriented parallel environments
Report No.(s): DE99-002602; LA-UR-98-3839; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
   POOMA is a templated C++ class library for use in the development of large-scale scientific simulations on serial and parallel computers. POOMA II is a new design and implementation of POOMA intended to add richer capabilities and greater flexibility to the framework. The new design employs a generic Array class that acts as an interface to, or view on, a wide variety of data representation objects referred to as engines. This design separates the interface and the representation of multidimensional arrays. The separation is achieved using compile-time techniques rather than virtual functions, and thus code efficiency is maintained. POOMA II uses PETE, the Portable Expression Template Engine, to efficiently represent complex mathematical expressions involving arrays and other objects. The representation of expressions is kept separate from expression evaluation, allowing the use of multiple evaluator mechanisms that can support nested where-block constructs, hardware-specific optimizations and different run-time environments.
NTIS
Subroutine Libraries (Computers); Design Analysis; Programming Languages

19990103097 Unisys Corp., Greenbelt, MD USA
Continuous Risk Management: An Overview
Rosenberg, Linda, Unisys Corp., USA; Hammer, Theodore F., NASA Goddard Space Flight Center, USA; 1999; In English; Risk,

Mar. 1999, Greenbelt, MD, USA

Software risk management is important because it helps avoid disasters, rework, and overkill, but more importantly because it stimulates win-win situations. The objectives of software risk management are to identify, address, and eliminate software risk items before they become threats to success or major sources of rework. In general, good project managers are also good managers of risk. It makes good business sense for all software development projects to incorporate risk management as part of project management. The Software Assurance Technology Center (SATC) at NASA GSFC has been tasked with the responsibility for developing and teaching a systems level course for risk management that provides information on how to implement risk management. The course was developed in conjunction with the Software Engineering Institute at Carnegie Mellon University, then tailored to the NASA systems community. This is an introductory tutorial to continuous risk management based on this course. The rational for continuous risk management and how it is incorporated into project management are discussed. The risk management structure of six functions is discussed in sufficient depth for managers to understand what is involved in risk management and how it is implemented. These functions include: (1) Identify the risks in a specific format; (2) Analyze the risk probability, impact/severity, and timeframe; (3) Plan the approach; (4) Track the risk through data compilation and analysis; (5) Control and monitor the risk; (6) Communicate and document the process and decisions.

Author

Project Management; Risk; Software Engineering; Software Reliability; Computer Systems Performance; Reliability Analysis

19990103098 Unisys Corp., Software Assurance Technology Center, Greenbelt, MD USA

When is Testing Sufficient

Rosenberg, Linda H., Unisys Corp., USA; Arthur, James D., Virginia Technologies, Inc., USA; Stapko, Ruth K., Unisys Corp., USA; Davani, Darush, Towson State Univ., USA; February 1999; In English; American Society for Metals (ASM) Metrics, February 1999, San Jose, CA, USA; Sponsored by American Society for Metals, USA

The Software Assurance Technology Center (SATC) at NASA Goddard Space Flight Center has been investigating how projects can determine when sufficient testing has been completed. For most projects, schedules are underestimated, and the last phase of the software development, testing, must be decreased. Two questions are frequently asked: "To what extent is the software error-free?" and "How much time and effort is required to detect and remove the remaining errors?" Clearly, neither question can be answered with absolute certainty. Nonetheless, the ability to answer these questions with some acceptable level of confidence is highly desirable. First, knowing the extent to which a product is error-free, we can judge when it is time to terminate testing. Secondly, if errors are judged to be present, we can perform a cost/benefit trade-off analysis to estimate when the software will be ready for use and at what cost. This paper explains the efforts of the SATC to help projects determine what is sufficient testing and when is the most cost-effective time to stop testing.

Derived from text

Computer Programming; Software Engineering; Software Reliability; Systems Engineering; Computer Systems Performance; Program Verification (Computers); Checkout; Proving; Acceptability

19990103129 NASA Wallops Flight Facility, Wallops Island, VA USA

ICESat (GLAS) Science Processing Software Document Series, Volume 2, Science Data Management Plan, 4.0

Jester, Peggy L., Raytheon Co., USA; Hancock, David W., III, NASA Wallops Flight Facility, USA; July 1999; 72p; In English

This document provides the Data Management Plan for the GLAS Standard Data Software (SDS) supporting the GLAS instrument of the EOS ICESat Spacecraft. The SDS encompasses the ICESat Science Investigator-led Processing System (I-SIPS) Software and the Instrument Support Facility (ISF) Software. This Plan addresses the identification, authority, and description of the interface nodes associated with the GLAS Standard Data Products and the GLAS Ancillary Data.

Author

Data Management; Management Planning; Data Base Management Systems

19990103604 NASA Marshall Space Flight Center, Huntsville, AL USA

Darwinian Spacecraft: Soft Computing Strategies Breeding Better, Faster Cheaper

Noever, David A., NASA Marshall Space Flight Center, USA; Baskaran, Subbiah, NASA Marshall Space Flight Center, USA;

1999; 3p; In English; Advanced Propulsion, 6 Apr. 1999, Huntsville, AL, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Computers can create infinite lists of combinations to try to solve a particular problem, a process called "soft-computing." This process uses statistical comparables, neural networks, genetic algorithms, fuzzy variables in uncertain environments, and flexible machine learning to create a system which will allow spacecraft to increase robustness, and metric evaluation. These concepts will allow for the development of a spacecraft which will allow missions to be performed at lower costs.
Author
Genetic Algorithms; Machine Learning; Neural Nets; Artificial Intelligence; Adaptive Control; Statistical Analysis; Data Processing

19990103929 Rutherford Appleton Lab., Computational Science and Engineering Dept., Chilton, UK
SQP Methods for Large-Scale Nonlinear Programming
Gould, N. I. M.; Toint, P. L.; Aug. 13, 1999; ISSN 1358-6254; 32p; In English; 19th; System Modelling and Optimization, 12-16 Jul. 1999, Cambridge, UK
Report No.(s): PB99-168718; RAL-TR-1999-055; Copyright; Avail: National Technical Information Service (NTIS), Microfiche, Hardcopy

We compare and contrast a number of recent sequential quadratic programming (SQP) methods that have been proposed for the solution of large-scale nonlinear programming problems. Both line-search and trust-region approaches are considered, as are the implications of interior-point and quadratic programming methods.
NTIS
Nonlinear Programming; Quadratic Programming

19990103931 National Aerospace Lab., Tokyo Japan
Characteristic Parameters of the NWT Computer System in the Global Memory Access
Hatayama, S.; Oct. 1998; 30p; In English
Report No.(s): PB99-169658; NAL-TR-1362T; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The NWT computer system available at the NAL since February 1993 comprises two system administrators, n processing elements (where n was 140 at the beginning, and is 166 at present) and a crossbar network, and operates as a distributed-memory message-passing MIMD computer. This paper reports measurements of two pairs of the characteristic parameters, (r(sub infinity), n (sub 1/2)) and ((angular momentum)r (sub infinity), (angular momentum)s(sub 1/2), f (sub 1/2)), of the NWT with the communication performance between the global and local memory spaces through the medium of the crossbar network and with MIMD computing in the global memory access, respectively. The significance of the results is interpreted, and several hardware parameters are estimated. The results in this paper apply only to the NWT system software during the period April to June 1993.
NTIS
Distributed Processing; Distributed Memory; Memory (Computers); Wide Area Networks; Access Control

19990104348 Sanders Associates, Inc., Nashua, NH USA
Embedded Signal Processor for UUV Applications *Final Report, Sep. 1995 - Dec. 1997*
Spain, Les; Jun. 1999; 21p; In English
Contract(s)/Grant(s): F30602-95-C-0278; AF Proj. D002
Report No.(s): AD-A366288; AFRL-IF-RS-TR-1999-126; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The objectives of the Unmanned Undersea Vehicle (UUV) program was to provide High Performance Scaleable Computing (HPSC) technology developed at Lockheed Martin in a scaleable 24 GFLOP HPSC processor for 21 inch UUV applications. The demonstration platform was to extend prior work that was done under Martin Labs (now integrated with Lockheed Sanders) for NUWC (the DAP system) by integrating HPSC technology to transform the DAP system into a real time embedded system suitable for UUVSP applications. It was decided that Naval Undersea Warfare Center (NUWC) would provide bottom-mapping algorithms for this demonstration. This algorithm was known as the Bathymetric Algorithm. This algorithm was provided to Sanders as a C program that ran on a UNIX workstation. Sanders was responsible for tailoring this algorithm into a scaleable process. The algorithm was tailored to use the Wideband Computers Inc. ADSP-21K Optimized DSP Library, and technology developed under the HPSC program for moving information between processing resources.
DTIC
Signal Processing; Underwater Vehicles; Signal Analyzers

19990105706 New Mexico State Univ., Klipsch School of Electrical and Computer Engineering, Las Cruces, NM USA

Concatenated Coding and Iterative SOVA Decoding with PR4 Signaling

Ghrayeb, Ali, Arizona Univ., USA; Ryan, William E., Arizona Univ., USA; August 1999; 16p; In English

Report No.(s): NMSU-ECE-99-009; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We examine the performance of the iterative soft-output Viterbi algorithm (SOVA) for parallel and serial concatenated codes on a precoded Class IV partial response (PR4) channel, and compare its performance to that of the iterative APP algorithm. We simulate the SOVA algorithm with a slight deviation from the way it is presented in literature and compare the performance of the two approaches. Code rates of the form $\{k(sub\ 0)/(k(sub\ 0) + 1)\}$ $(k(sub\ 0) = 4, 8,$ and $64)$ are considered. Our simulations indicate that the loss at $P(sub\ b) = 10(exp\ -5)$ suffered by the SOVA is at most 1.2 dB for parallel concatenations and at most 1.6 dB for serial concatenations.

Author

Algorithms; Decoding; Viterbi Decoders; Computer Programs; Software Engineering; Computerized Simulation

19990105717 Department of Defense, Office of the Inspector General, Arlington, VA USA

Year 2000 Issues Within the US Pacific Command's Area of Responsibility: Hawaii Information Transfer System

Feb. 22, 1999; 17p; In English

Contract(s)/Grant(s): Proj-8CC-0049

Report No.(s): AD-A367369; IG/DOD-99-031; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This is one in a series of reports being issued by the Inspector General, DoD, in accordance with an informal partnership with the Chief Information Officer, DoD, to monitor DoD efforts to address the year 2000 computing challenge. For a listing of audit projects addressing the issue, see the year 2000 webpage on the IGnet at http://www.ignet.gov. The overall audit objective was to evaluate whether DoD adequately planned for and managed year 2000 risks to avoid disruptions to the U.S. Pacific Command mission. Specifically, the IG reviewed year 2000 risk assessments, contingency plans for mission critical systems, and continuity of operations plans to perform core mission requirements. The review included major DoD communications systems operating within the U.S. Pacific Command's area of responsibility. The Hawaii Information Transfer System (HITS) program managers, the Defense information System Agency, and the Naval Computer and Telecommunications Area Master Station-Pacific recognized the need for contract clauses and procedures to ensure Y2K compliance for the HITS program. The HITS contractor was required to ensure that all hardware and software assets were Y2K compliant and the contract specified that there could be no additional charges to the government for Y2K upgrades. Further, the implementation of HITS Y2K upgrades to existing systems was on schedule. Provided was a draft of this report on January 15, 1999. Because this report contains no findings or recommendations, written comments were not required, and none were received. Therefore, this report is being published in its final form.

DTIC

Information Transfer; Information Systems; Information Flow; Defense Program; Risk

62
COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

19990100605 Department of Energy, Assistant Secretary for Management and Administration, Washington, DC USA

Improving scalability with loop transformations and message aggregation in parallel object-oriented frameworks for scientific computing

Bassetti, F.; Davis, K.; Quinlan, D.; Dec. 31, 1998; 7p; In English; 4th; USENIX conference on object-oriented technologies and systems (COOTS)

Report No.(s): DE98-006294; LA-UR-98-1175; CONF-980464; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Application codes reliably achieve performance far less than the advertised capabilities of existing architectures, and this problem is worsening with increasingly-parallel machines. For large-scale numerical applications, stencil operations often impose the great part of the computational cost, and the primary sources of inefficiency are the costs of message passing and poor cache utilization. This paper proposes and demonstrates optimizations for stencil and stencil-like computations for both serial and parallel environments that ameliorate these sources of inefficiency. Achieving scalability, they believe, requires both algorithm design and compile-time support. The optimizations they present are automatable because the stencil-like computations are implemented

at a high level of abstraction using object-oriented parallel array class libraries. These optimizations, which are beyond the capabilities of today compilers, may be performed automatically by a preprocessor such as the one they are currently developing.
NTIS
Messages; Object-Oriented Programming; Parallel Processing (Computers); Loops

19990100671 Department of Energy, Office of Energy Research, Washington, DC USA
Computing, information, and communications: Technologies for the 21 Century
Dec. 31, 1998; 84p; In English
Report No.(s): DE99-000174; DOE/ER/25232-T1-PT.2; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

To meet the challenges of a radically new and technologically demanding century, the Federal Computing, Information, and Communications (CIC) programs are investing in long-term research and development (R and D) to advance computing, information, and communications in the USA. CIC R and D programs help Federal departments and agencies to fulfill their evolving missions, assure the long-term national security, better understand and manage the physical environment, improve health care, help improve the teaching of children, provide tools for lifelong training and distance learning to the workforce, and sustain critical US economic competitiveness. One of the nine committees of the National Science and Technology Council (NSTC), the Committee on Computing, Information, and Communications (CCIC)--through its CIC R and D Subcommittee--coordinates R and D programs conducted by twelve Federal departments and agencies in cooperation with US academia and industry. These R and D programs are organized into five Program Component Areas: (1) HECC--High End Computing and Computation; (2) LSN--Large Scale Networking, including the Next Generation Internet Initiative; (3) HCS--High Confidence Systems; (4) HuCS- -Human Centered Systems; and (5) ETHR--Education, Training, and Human Resources. A brief synopsis of FY 1997 accomplishments and FY 1998 goals by PCA is presented. This report, which supplements the President's Fiscal Year 1998 Budget, describes the interagency CIC programs.
NTIS
Computation; Research and Development; Information Systems

19990102798 Air Force Inst. of Tech., Center for Distance Education, Wright-Patterson AFB, OH USA
Government Education and Training Network (GETN)
Westfall, Philip J.–L., Air Force Inst. of Tech., USA; Advanced Training Technologies and Learning Environments; July 1999, pp. 457-461; In English; See also 19990102782; No Copyright; Avail: CASI; A01, Hardcopy; A04, Microfiche

The Center for Distance Education (CDE), localed at the Air Force Institute of Technology (AFIT), Wright-Pafterson AFB, OH, conceived and developed a satellite-based, interactive television (ITV) network to meet distance learning needs of AFIT, but with the vision of creating a government-wide distance learning network, which the CDE dubbed the Government Education and Training Network (GETN). CDE's network, called Air Technology Network (ATN), consists of a one way, digital- video up-link earthstation, reaching receive-only, down4ink earthstations, but with two way audio interaction. ATN uses cost effective compressed digital video (CDV) technology for video and a terrestrial, push-to-talk audio-conferencing system manufactured by AT Products, Inc.,for two-way audio interaction .
Author
Digital Television; Education; Information Systems; Satellite Networks; Telecommunication

19990103346 Air Force Academy, CO USA
Building Castles on Sand? Ignoring the Rip Tide of Information Operations
Bass, Carla D.; Apr. 01, 1998; 69p; In English
Report No.(s): AD-A367312; AU/AWC/RWP059/1998-04; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This paper will attempt to prove that a CINC for IO is now necessary to capture the plethora of ongoing IO related activities and hone them into a single, powerful, coordinated capability. Furthermore, using Special Operations Command as a model, responsibility for IO should be assigned to an extent Unified Command. This additional mission should be accompanied by a designated program element to eliminate sporadic, uncoordinated, and oftentimes insufficient 10 expenditures, and to more efficiently distribute lessons learned across DoD.
DTIC
Information Systems; Military Technology; Electronic Warfare

19990103939 General Accounting Office, Accounting and Information Management Div., Washington, DC USA

Federal Information System Controls Audit Manual, Volume 1, Financial Statement Audits

Jan. 1999; 276p; In English

Report No.(s): PB99-171704; GAO/AIMD-12.19.6; No Copyright; Avail: CASI; A03, Microfiche; A13, Hardcopy

This manual describes the computer-related controls that auditors should consider when assessing the integrity, confidentiality, and availability of computerized data. It is a guide applied by GAO primarily in support of financial statement audits and is available for use by other government auditors. It is not an audit standard. Its purposes are to inform financial auditors about computer-related controls and related audit issues so that they can better plan their work and integrate the work of information systems (IS) auditors with other aspects of the financial audit and provide guidance to IS auditors on the scope of issues that generally should be considered in any review of computer-related controls over the integrity, confidentiality, and availability of computerized data associated with federal agency systems.

NTIS

Financial Management; Management Information Systems

19990104351 New Jersey Inst. of Tech., Dept. of Electrical and Computer Engineering, Newark, NJ USA

Design, Implementation, and Evaluation of a Shared-Memory Parallel Processing System (SMPPS)

Staub, Eric H.; Jul. 26, 1999; 100p; In English

Report No.(s): AD-A366346; AFIT-FY99-203; No Copyright; Avail: CASI; A02, Microfiche; A05, Hardcopy

Even with ever changing technology, industry is always looking for ways to improve performance. Scientists are continually finding innovative ways to speed up the processing power of computers. Still, we need faster and more effective ways to accomplish a task. Now that advancements in technology are reaching their limits, industry must look for a new way to keep up with the demands. There is the old adage that two minds are greater than one. This theory can be applied to computer processing. With two processors, not only can more tasks be accomplished, but also tasks can be accomplished faster.

DTIC

Memory (Computers); Parallel Processing (Computers)

19990104379 NASA Goddard Space Flight Center, Greenbelt, MD USA

An Efficient Objective Analysis System for Parallel Computers

Stobie, J., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Reanalysis, 23-27 Aug. 1999, Reading, UK; Sponsored by European Centre for Medium-Range Weather Forecasts, UK

Contract(s)/Grant(s): NAS5-32332; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A new atmospheric objective analysis system designed for parallel computers will be described. The system can produce a global analysis (on a 1 X 1 lat-lon grid with 18 levels of heights and winds and 10 levels of moisture) using 120,000 observations in 17 minutes on 32 CPUs (SGI Origin 2000). No special parallel code is needed (e.g. MPI or multitasking) and the 32 CPUs do not have to be on the same platform. The system is totally portable and can run on several different architectures at once. In addition, the system can easily scale up to 100 or more CPUS. This will allow for much higher resolution and significant increases in input data. The system scales linearly as the number of observations and the number of grid points. The cost overhead in going from 1 to 32 CPUs is 18%. In addition, the analysis results are identical regardless of the number of processors used. This system has all the characteristics of optimal interpolation, combining detailed instrument and first guess error statistics to produce the best estimate of the atmospheric state. Static tests with a 2 X 2.5 resolution version of this system showed it's analysis increments are comparable to the latest NASA operational system including maintenance of mass-wind balance. Results from several months of cycling test in the Goddard EOS Data Assimilation System (GEOS DAS) show this new analysis retains the same level of agreement between the first guess and observations (O-F statistics) as the current operational system.

Author

Parallel Computers; Data Systems; Mass Distribution; Static Tests; Seeing (Astronomy)

Includes feedback and control theory, artificial intelligence, robotics and expert systems. For related information see also 54 Man/ System Technology and Life Support.

19990100677 Tennessee Univ. Space Inst., Mechanical, Aerospace and Engineering Science, Tullahoma, TN USA
Precision Interval Estimation of the Response Surface by Means of an Integrated Algorithm of Neural Network and Linear Regression *Final Report, May - Sep. 1999*
Lo, Ching F., Tennessee Univ. Space Inst., USA; September 1999; 39p; In English
Contract(s)/Grant(s): NAG1-2185; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
 The integration of Radial Basis Function Networks and Back Propagation Neural Networks with the Multiple Linear Regression has been accomplished to map nonlinear response surfaces over a wide range of independent variables in the process of the Modem Design of Experiments. The integrated method is capable to estimate the precision intervals including confidence and predicted intervals. The power of the innovative method has been demonstrated by applying to a set of wind tunnel test data in construction of response surface and estimation of precision interval.
Author
Algorithms; Estimating; Neural Nets; Experiment Design

19990101887 Indian Inst. of Tech., Kanpur, India
Two New Techniques for Aircraft Parameter Estimation using Neural Networks
Raisinghani, S. C., Indian Inst. of Tech., India; Ghosh, A. K., Indian Inst. of Tech., India; Kalra, P. K., Indian Inst. of Tech., India; The Aeronautical Journal; Jan. 1998; Volume 102, No. 1011, pp. 25-30; In English; See also 19990101884
Report No.(s): Paper 2349; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
 Two new techniques for estimating aircraft stability and control derivatives (parameters) from flight data using feed forward neural networks are proposed. Both techniques use motion variables and control inputs as the input file, while aerodynamic coefficients are presented as the output file for training a neural network. For the purpose of parameter estimation the trained neural network is presented with a suitably modified input file, and the corresponding predicted output file of aerodynamic coefficients is obtained. Suitable interpretation and manipulation of such input-output file yields the estimated values of the parameters. The methods are validated first on the simulated flight data and then on real flight data obtained by digitizing analog data from a published report. Results are presented to show how the accuracy of the estimates is affected by the topology of the network, the number of iterations and the intensity of the measurement noise in simulated flight data. One of the significant features of the proposed method is that they do not require guessing of a reasonable set of starting values of the parameters as a popular parameter estimator like the maximum likelihood method does.
Author
Aircraft Stability; Neural Nets; Aircraft Control; Control Equipment; Estimating; Feedforward Control; Flight Simulation

19990102203 Carnegie-Mellon Univ., Dept. of Computer Science, Pittsburgh, PA USA
Reinforcement Learning Through Gradient Descent
Baird, Leemon C., III; May 14, 1999; 79p; In English
Report No.(s): AD-A366344; CMU-CS-99-132; AFIT-FY99-159; Copyright; Avail: Defense Technical Information Center (DTIC), Microfiche, Hardcopy
 Reinforcement learning is often done using parameterized function approximators to store value functions. Algorithms are typically developed for lookup tables, and then applied to function approximators by using backpropagation. This can lead to algorithms diverging on very small, simple MDPs and Markov chains, even with linear function approximators and epoch wise training. These algorithms are also very difficult to analyze, and difficult to combine with other algorithms. A series of new families of algorithms are derived based on stochastic gradient descent. Since they are derived from first principles with function approximators in mind, they have guaranteed convergence to local minima, even on general nonlinear function approximators. For both residual algorithms and VAPS algorithms, it is possible to take any of the standard algorithms in the field, such as Q-learning or SARSA or value iteration, and rederive a new form of it with provable convergence. In addition to better convergence properties, it is shown how gradient descent allows an inelegant, inconvenient algorithm like Advantage updating to be converted into a much simpler and more easily analyzed algorithm like Advantage learning. In this case that is very useful, since Advantages can be learned thousands of times faster than Q values for continuous time problems. In this case, there are significant practical benefits of using gradient descent based techniques. In addition to improving both the theory and practice of existing types of algorithms, the gradient descent approach makes it possible to create entirely new classes of reinforcement learning algorithms. VAPS algo-

rithms can be derived that ignore values altogether, and simply learn good policies directly. One hallmark of gradient descent is the ease with which different algorithms can be combined, and this is a prime example.
DTIC
Education; Gradients; Descent; Machine Learning

19990103082 Physics and Electronics Lab. TNO, The Hague, Netherlands
Vehicle Recognition in Infrared Images Using Shared Weights Neural Networks *Final Report*
deRidder, D., Physics and Electronics Lab. TNO, Netherlands; Schutte, K., Physics and Electronics Lab. TNO, Netherlands; Schwering, P. B. W., Physics and Electronics Lab. TNO, Netherlands; Breuers, M. G. J., Physics and Electronics Lab. TNO, Netherlands; January 1999; 60p; In English
Contract(s)/Grant(s): A94KL641; TNO Proj. 24303
Report No.(s): TD-98-0201; FEL-98-A048; Copyright; Avail: Issuing Activity, Hardcopy
     Automatic target recognition (ATR) is part of a tendency to replace people in increasingly more complicated warfare tasks. Possible applications of this type of technology might be remotely piloted vehicles (RPV), assistance of human observers in order to reduce their workload and the study of the effectiveness of camouflage techniques. In this report the use of shared weight and radial basis neural networks in wheel recognition is studied. Experiments that were carried out using real world infrared images indicate that neural networks can achieve reasonable performance in wheel recognition.
Author
Infrared Imagery; Target Recognition; Effectiveness; Technology Assessment

19990103347 Boston Univ., Center for Adaptive Systems, Boston, MA USA
Self-Organizing Neural Circuits for Sensory-Guided Motor Control *Final Report, 1 Jan. 1992-30 Sep. 1998*
Grossberg, Stephen; Bullock, Daniel; Aug. 26, 1999; 20p; In English
Contract(s)/Grant(s): N00014-92-J-1309
Report No.(s): AD-A367309; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
     The reported projects developed mathematical models to explain how self-organizing neural circuits that operate under continuous or intermittent sensory guidance achieve flexible and accurate control of human movement. Neural models were developed for the control of visually guided arm/hand movements, saccadic eye movements, and limb gait transitions. These circuits generate movement trajectories, adapt movement execution on the fly to unforseen contingencies, and improve accuracy over time by learning to act in anticipation of predictable contingencies. The circuits meet behavioral, neurobiological, and design constraints. Thus, the proposed circuits have operating characteristics that match those documented for human performance and learning, such as voluntary control of speed and amplitude, transfer of learning, and learned recovery from damage to parts of a circuit. The circuits also exhibit stability, robustness, short-term flexibility, and long-term adaptability. The circuits also provide an integrative explanation of many neuroanatomical, neurophysiological, and biophysical observations. by satisfying
DTIC
Human Performance; Neuropsychiatry; Information Processing (Biology); Human Behavior; Biophysics; Nervous System

19990103610 Electrotechnical Lab., Tsukuba, Japan
Study on The Hopfield Neural Networks for Solving Combinatorial Optimization Problems
Tanaka, Toshio, Electrotechnical Lab., Japan; Researches of the Electrotechnical Lab.; April 1999; ISSN 0366-9106, No. 987, pp. 1-65; In Japanese; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche
     Types of combinatorial optimization problems include the Traveling Salesman Problem (TSP), knapsack problem, maximum satisfiability problem, and independent set problem. In particular, studies have actively been conducted on TSPs, and many methodologies have been proposed for use in applied problems, such as scheduling problems in the distribution industry, problems of drilling printed circuit boards, and Very Large Scale Integrated (VLSI) wiring problems. The 2-opt method and the Lin-Kernighan method are major conventional approximation methods for solving TSPs. It has been reported empirically that solutions can be obtained by the 2-opt method and by the Lin-Kernighan method at a rate of 7 to 8% and 1 to 2% of the optimum solution, respectively. On the other hand, a recurrent neural network (Hopfield network), with which the connection weight of neurons is symmetrical, has recently been attracting attention because of its parallel distributed processing capability. When solving combinatorial optimization problems with Hopfield networks, in general, we first design an energy function such that the solution of the problem is achieved when the energy reaches its lowest state. Then a convenient initial state is assigned to the network and a neuron is selected at random. When the output of the selected neuron is changed according to state transition rules, the network energy func-

tion decreases. Repeating these steps, we then reduce the energy function continually until a stable state is reached, and in that way the optimization problem may be considered solved.
Author
Neural Nets; Combinatorial Analysis; Optimization

19990104276 NASA Pasadena Office, CA USA
Neural Network Training by Integration of Adjoint Systems of Equations Forward in Time
Toomarian, Nikzad, Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Barhen, Jacob, Inventor, Jet Propulsion Lab., California Inst. of Tech., USA; Jul. 27, 1999; In English
Patent Info.: Filed 27 Oct. 1992; NASA-Case-NPO-18586-1-CU; US-Patent-5,930,781; US-Patent-Appl-SN-969868; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

A method and apparatus for supervised neural learning of time dependent trajectories exploits the concepts of adjoint operators to enable computation of the gradient of an objective functional with respect to the various parameters of the network architecture in a highly efficient manner. Specifically. it combines the advantage of dramatic reductions in computational complexity inherent in adjoint methods with the ability to solve two adjoint systems of equations together forward in time. Not only is a large amount of computation and storage saved. but the handling of real-time applications becomes also possible. The invention has been applied it to two examples of representative complexity which have recently been analyzed in the open literature and demonstrated that a circular trajectory can be learned in approximately 200 iterations compared to the 12000 reported in the literature. A figure eight trajectory was achieved in under 500 iterations compared to 20000 previously required. Tbc trajectories computed using our new method are much closer to the target trajectories than was reported in previous studies.
Author
Neural Nets; Belief Networks; Artificial Intelligence; Education; Transfer of Training

19990104352 Electrotechnical Lab., Tsukuba, Japan
Current Status of Research on Neural Networks with High-Dimensional Parameters
Nitta, Tohru, Electrotechnical Lab., Japan; Circulars of the Electrotechnical Laboratory; January 1999; ISSN 0366-9106, pp. 1-58; In Japanese
Report No.(s): Rept-228; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

Complex systems have been attracting much interest in recent years all over the world. There exists a computational tool called Complex Adaptive Systems for dealing with complex systems, which is based on a comprehensive concept including the features of evolvable or learnable systems such as living creatures. Artificial neural networks can be considered to be a type of complex adaptive system. So far, it has been confirmed that artificial neural net-works have the ability to learn, generalize and associate, and they have been applied to various fields such as image processing and speech recognition. Although the usual neural network is a sort of complex adaptive system, it is too simple to adequately handle complex systems such as economic phenomena, global environmental phenomena and the like. In the meantime, there have been several attempts to extend the parameters (weight and thresholds) of the usual neural networks to higher dimensions (complex numbers, three-dimensional vectors, quaterninons, etc.). In this paper, we call such neural networks with high-dimensional parameter high-dimensional neural networks. High-dimensional neural networks will extend the application domains of artificial neural networks, and will facilitate the application of artificial neural networks. We believe that the high-dimensional neural networks can also treat complex systems very well. This paper will survey the current status of research on high-dimensional neural networks. In Chapter 2, the current status of research on high-dimensional autoregressive models, which are the fundamental theoretical basis of high-dimensional neural networks, is described. In general, there is a close relationship between autoregressive models and neural networks in the sense that the autoregressive model is a linear approximation to the artificial neural network with non-linearity. The progress of research on high-dimensional autoregressive models facilitates research on high-dimensional neural networks. Chapter 3 surveys the current status of research on multi-layered high-dimensional neural networks. Some kinds of complex-valued, ..., quaternion-valued neural network models, their characteristics and their applications will be described. Chapter 4 outlines the current status of research on fully connected recurrent high-dimensional neural networks. only complex-valued ones have been proposed so far. Chapter 5 discusses future research topics.
Derived from text
Neural Nets; Independent Variables

19990105807 Defence Science and Technology Organisation, Information Technology Div., Canberra Australia
Genetically Optimized Feedforward Neural Networks for Speaker Identification
Price, Richard; Willmore, Jonathan; Roberts, William; May 1999; 18p; In English

Report No.(s): AD-A367247; DSTO-TN-0203; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

    The problem of establishing the identity of a speaker from a given utterance has been conventionally addressed using techniques such as Gaussian Mixture Models (GMMs) that model the characteristics of a known speaker via means and covariances. In this paper we pose the task as a binary classification problem, and whilst in principle any one of a number of classifiers could be applied, this work compares the performance of genetically optimized neural networks versus the conventional approach of GMMs. The test data used in the experiments was the data used for the 1996 National Institute for Standards Technology (MST) evaluation of speaker identification systems.
DTIC
Neural Nets; Speech Recognition; Artificial Intelligence

64
NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

19990103359 NASA Goddard Space Flight Center, Greenbelt, MD USA
Single-Expansion EBCM Computations for Osculating Spheres
Mishchenko, Michael I., NASA Goddard Space Flight Center, USA; Videen, Gorden, Army Research Lab., USA; [1999]; 10p; In English
Report No.(s): GCN-99-37; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

    We show that the standard, single-expansion extended boundary condition method provides convergent scattering results for osculating dielectric spheres and discuss the implications of this result.
Author
Boundary Conditions; Matrix Methods; Computation; Electromagnetic Scattering

19990104333 Ben Gurion Univ. of the Negev, Dept. of Industrial Engineering and Management, Beersheva, Israel
The Newton Modified Barrier Method for QP Problems
Melman, A., Ben Gurion Univ. of the Negev, Israel; Polyak, R., George Mason Univ., USA; Annals of Operations Research; 1996; Volume 62, pp. 465-519; In English
Contract(s)/Grant(s): NAGw-1397; NSF DMS-94-03218; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

    The Modified Barrier Functions (MBF) have elements of both Classical Lagrangians (CL) and Classical Barrier Functions (CBF). The MBF methods find an unconstrained minimizer of some smooth barrier function in primal space and then update the Lagrange multipliers, while the barrier parameter either remains fixed or can be updated at each step. The numerical realization of the MBF method leads to the Newton MBF method, where the primal minimizer is found by using Newton's method. This minimizer is then used to update the Lagrange multipliers. In this paper, we examine the Newton MBF method for the Quadratic Programming (QP) problem. It will be shown that under standard second-order optimality conditions, there is a ball around the primal solution and a cut cone in the dual space such that for a set of Lagrange multipliers in this cut cone, the method converges quadratically to the primal minimizer from any point in the aforementioned ball, and continues to do so after each Lagrange multiplier update. The Lagrange multipliers remain within the cut cone and converge linearly to their optimal values. Any point in this ball will be called a "hot start". Starting at such a "hot start", at most Omicron(1n 1n epsilon(exp -1)) Newton steps are sufficient to perform the primal minimization which is necessary for the Lagrange multiplier update. Here, epsilon is greater than 0 is the desired accuracy. Because of the linear convergence of the Lagrange multipliers, this means that only Omicron(1n epsilon(exp -1))omicron(ln 1n epsilon(exp-1)) Newton steps are required to reach an epsilon-approximation to the solution from any "hot start". In order to reach the "hot start", one has to perform Omicron(square root(m) 1n C) Newton steps, where m characterizes the size of the problem and C is greater than 0 is the condition number of the QP problem. This condition number will be characterized explicitly in terms of key parameters of the QP problem, which in turn depend on the input data and the size of the problem.
Author
Convergence; Lagrange Multipliers; Newton Methods; Quadratic Programming; Mathematical Logic; Theorem Proving

19990105694 Minnesota Univ., School of Mathematics, Minneapolis, MN USA
Partial Differential Equations from the Materials Sciences: Analysis and Computation *Final Report, 1 Jan. 1995 - 30 Jun. 1998*
Reitich, Fernando; Martin, Robert; Jun. 30, 1998; 12p; In English
Contract(s)/Grant(s): F49620-95-1-0113

Report No.(s): AD-A367324; AFRL-SR-BL-TR-99-0194; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

This report describes accomplishments in the areas of electromagnetic scattering and smart materials achieved under Grant No. F49620-95-1-0113. With regards to problems of wave propagation, advances in the development of high-order perturbation methods are reported. These include the derivation and coding of algorithms for the numerical solution of the scalar and vector forward scattering problems for two- and three-dimensional configurations and the formulation of corresponding approaches to inverse scattering calculations and to the estimation of normal and quasi-normal cavity modes. Concurrent achievements in the study of smart materials are also recounted here. They include the development of nonlinear homogenization theories intended to capture overall elastic behaviors (e.g., of shape-memory alloys, SMA), or magnetic and rheological responses (such as those of magnetorheological fluids, MRF). The latter project was undertaken in collaboration with scientists at the Lord Corporation, the worldwide leader in MRF technology, and was geared towards the incorporation of advanced mathematical modeling and simulations into the design of MRF.
DTIC
Partial Differential Equations; Computation; Numerical Analysis

65
STATISTICS AND PROBABILITY

Includes data sampling and smoothing: Monte Carlo method; and stochastic processes.

19990103372 Los Alamos National Lab., NM USA
Possibilistic systems within a general information theory
Joslyn, C.; Dec. 31, 1999; 11p; In English; 1999 international symposium on inprecise probabilities and their application
Report No.(s): DE99-002740; LA-UR-99-853; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The author surveys possibilistic systems theory and place it in the context of Imprecise Probabilities and General Information Theory (GIT). In particular, he argues that possibilistic systems hold a distinct position within a broadly conceived, synthetic GIT. The focus is on systems and applications which are semantically grounded by empirical measurement methods (statistical counting), rather than epistemic or subjective knowledge elicitation or assessment methods. Regarding fuzzy measures as special provisions, and evidence measures (belief and plausibility measures) as special fuzzy measures, thereby he can measure imprecise probabilities directly and empirically from set-valued frequencies (random set measurement). More specifically, measurements of random intervals yield empirical fuzzy intervals. In the random set (Dempster-Shafer) context, probability and possibility measures stand as special plausibility measures in that their distributionality (decomposability) maps directly to an aggregable structure of the focal classes of their random sets. Further, possibility measures share with imprecise probabilities the ability to better handle open world problems where the universe of discourse is not specified in advance. In addition to empirically grounded measurement methods, possibility theory also provides another crucial component of a full systems theory, namely prediction methods in the form of finite (Markov) processes which are also strictly analogous to the probabilistic forms.
NTIS
Probability Theory; Information Theory; Fuzzy Sets; Markov Processes

19990103932 National Aerospace Lab., Tokyo Japan
Goodness-of-Fit Tests for the Type-I Extreme-Value and Two-Parameter Weibull Distributions with Unknown Parameters Estimated by Graphical Plotting Techniques. Part 1: Critical Values
Shimokawa, T.; Liao, M.; Feb. 1999; 20p; In English
Report No.(s): PB99-169666; NAL-TR-1371T; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The objective of this study is to determine the critical values of the Cramer-von Mises (C-M) and Anderson-Darling (A-D) statistics for goodness-of-fit tests for the Type-1 extreme-value and two-parameter Weibull distributions when the population parameters are estimated from a complete sample by graphical plotting techniques. Three kinds of graphical-plotting technique i.e., the median ranks, mean ranks, and symmetrical sample cumulative distribution (symmetrical ranks), are combined with the least-squares method on extreme-value and Weibull probability paper to estimate the parameters. Monte Carlo simulation is used to calculate the critical values of the C-M and A-D statistics, in which 1,000,000 sets of complete samples are generated ten times for each sample size of 3(1)20, 25(5)50, and 60(10)100. The critical values are discussed and tabulated for practical use.
NTIS
Goodness of Fit; Statistical Tests; Weibull Density Functions

National Aerospace Lab., Tokyo Japan

Goodness-of-Fit Tests for the Type-I Extreme-Value and Two-Parameter Weibull Distributions with Unknown Parameters Estimated by Graphical Plotting Techniques. Part 2: Power Study

Liao, M.; Shimokawa, T.; Feb. 1999; 22p; In English

Report No.(s): PB99-169674; NAL-TR-1372T; Copyright; Avail: National Technical Information Service (NTIS), Microfiche

The objective of this study was to investigate the power of the Kolmogorov-Smirnov, Cramer-von Mises, and Anderson-Darling statistics for goodness-of-fit tests for the Type-1 extreme-value and two-parameter Weibull distributions, when the population parameters were estimated by the combination of three kinds of graphical plotting techniques and the least-squares method and the maximum likelihood estimators. Monte Carlo simulation provided the power results using 10,000 repetitions for each sample size of 5, 10, 25, and 40. Four representative statistical distribution models were selected for alternative distributions in order to conduct the power comparison. The power comparisons indicated that the Anderson-Darling statistic coupled with the symmetrical ranks and the least-squares method is the most powerful statistic for goodness-of-fit tests, and is recommended for practical use.

NTIS

Goodness of Fit; Maximum Likelihood Estimates; Kolmogorov-Smirnov Test; Statistical Distributions; Probability Theory; Weibull Density Functions

66
SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

Norwegian Defence Research Establishment, Kjeller, Norway

Production of Fighter Pilots: A Case Study *Produksjon av Jagerflygere: En Casestudie*

Stang, Dagfinn, Norwegian Defence Research Establishment, Norway; Aug. 24, 1999; 38p; In Dutch

Contract(s)/Grant(s): Proj. FFISYS/732/161.1

Report No.(s): FFI/RAPPORT-99/01703; ISBN 82-464-0370-2; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The annual operating cost of the Norwegian Fighter sector in 1998 was over 860 million NOK, divided in half between costs related directly to fighters and pilots on the one hand and support personnel and equipment on the other. It must be noted that flying hours was less than 2/3 of what was indicated by the number of pilots. This means that the underlying operations costs are bearly 1,200 million NOK per year. Achieving a balance between the fighter structure need for pilots and the combined output of the production of pilots is a main issue in most nation's force planning. The study reveals the exact nature of this discrepancy and suggests closing the gap between the need for and availability of pilots at different levels of competence. A simulation model, based on a similar model developed for investigating similar issues for the submarine weapon, was slightly modified. Using this refined model for sensitivity analysis it was shown that efforts to improve pilot availability by only increasing recruitment will result in a chronic problem. If there are sufficient inexperienced pilots, then the price is short supply of experienced pilots. Conversely to achieve a good balance among the experienced ones, then inexperienced pilots will be in oversupply to the experienced ones. A balanced mix of various experience levels will only be achieved through lower losses among captains/majors. This will again require higher retention rates through competitive salaries. A planned purchase of 20 new aircrafts will make the need for retention even higher, especially if accelerated and completed before year 2010. Methodically, the effort required to tailor make the original submarine production simulation model to the fighter sector was minor with respect to reprogramming. On the other hand, the effort required to understand the underlying processes, and to populate the new model with data, took many many-months longer than expected even for personnel with long experience in defense costing, modelling, and force production.

Author

Operating Costs; Cost Estimates; Airline Operations

Air Force Academy, CO USA

How the Current View of the Air and Space Environment Influences Developments of Military Space Forces

Anderson, Lyndon S.; Rothstein, Stephen M.; Apr. 1998; 48p; In English

Report No.(s): AD-A367204; AU/ACSC/006/1998-04; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

Perceptions determine actions. The military's perception of the air and space environment influences the type of space it will develop in the future. This paper addresses the perception by answering the following question: How does the current view of the air and space environment influence the development of military space forces? The research method centered on surveying literature and interviewing DoD policy makers to develop the idea that the military's current organizational paradigm is a paradox

that sees space as a medium, separate from air, while at the same time, bound to it physically, theoretically, and historically. This paradox creates a dilemma that influences the military's ability to advocate and justify requirements, and ultimately garner resources to develop a viable space force. The paper develops measures of merit to show organizational evidence of how these linking and separating positions of the paradigm express themselves within the military. This has both positive and negative aspects for space development. It promotes a healthy climate for debate, but at the same time, frustrates DoD's ability to generate a healthy concept pull environment. The paper concludes by opening the door to ideas for resolving the dilemma the current paradigm presents.
DTIC
Aerospace Environments; Systems Analysis

19990104604 Air Force Academy, CO USA
Transitioning to a Space & Air Force: Moving Beyond Rhetoric?
Johnson–Freese, Joan; Apr. 01, 1998; 28p; In English
Report No.(s): AD-A367211; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

    Efforts within the Air Force to integrate its two primary components, air and space, have yielded at best slow and dubious results. Many space advocates and analysts assumed that the vital role space played in the Gulf War would result in space being recognized as warranting an equal position with the air component of the Air Force, if not the creation of a separate service. Although rhetoric has seemed to support those assumptions, actual progress has remained slow. In this paper, the role played by organizational culture and an indicator of organizational commitment, is also considered. The trials of teaching and integrating space into an already existing structure at the senior Air Force Professional Military Education (PME) institution, the Air War College, is examined as illustrative. The conclusion reached is that the current environment is not conducive to integration, and that rhetoric will likely continue to outpace substantive progress, with potentially negative result.
DTIC
Education; Warfare

19990105695 Air Force Academy, Dean of Faculty, CO USA
USAFA Discovery, *Apr. - Jun. 1999*
Jun. 1999; 8p; In English
Report No.(s): AD-A367333; USAFA-1999-02; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

    This issue begins with a lead article: a new path to the moon and then Department Research news and ends with information on publications and presentations.
DTIC
Research Management; Armed Forces; Documents

67
THEORETICAL MATHEMATICS

Includes topology and number theory.

19990105829 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette France
Filtrations on Higher Algebraic K-Theory
Gillet, H.; Soule, C.; Dec. 1998; 72p
Report No.(s): PB99-129603; IHES/M/98/82; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

    This paper is organized as follows. In Section 1, we discuss the homotopy theory of simplicial sheaves over an arbitrary site, and we extend Joyal's theorem to the group case. In Section 2, we compare two exact couples attached to filtered simplicial groups, and we deduce from this a map of spectral sequences for sheaf cohomology. In Section 3, we define the K-theory of a locally ringed topos and prove the splitting principle. In Section 4, we define a lambda-structure on the K-groups of "K-coherent" simplicial sheaves. In Section 5, we compare the Quillen and Brown-Gersten spectral sequences as well as the different filtrations on the higher K-theory of a scheme. In Section 6, we use the splitting principle to study Chern slasses and in Section 7 we show that the Bloch-Lichtenbaum spectral sequence degenerates.
NTIS
Filtration; Algebra; Group Theory

For precision time and time interval (PTTI) see 35 Instrumentation and Photography; for geophysics, astrophysics or solar physics see 46 Geophysics, 90 Astrophysics, or 92 Solar Physics.

19990105888 Sandia National Labs., Albuquerque, NM USA

Efficient Global Optimization Under Conditions of Noise and Uncertainty: A Multi-Model Multi-Grid Windowing Approach

Romero, V. J.; May 18, 1999; 6p; In English; 3rd; 3rd World Conference of Structural and Multidisciplinary Optimization, 17-21 May 1999, Buffalo, NY, USA

Report No.(s): DE00-007256; SAND99-1244C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Incomplete convergence in numerical simulation such as computational physics simulations and/or Monte Carlo simulations can enter into the calculation of the objective function in an optimization problem, producing noise, bias, and topo- graphical inaccuracy in the objective function. These affect accuracy and convergence rate in the optimization problem. This paper is concerned with global searching of a diverse parameter space, graduating to accelerated local convergence to a (hopefully) global optimum, in a framework that acknowledges convergence uncertainty and manages model resolution to efficiently reduce uncertainty in the final optimum. In its own right, the global-to-local optimization engine employed here (devised for noise tolerance) performs better than other classical and contemporary optimization approaches tried individually and in combination on the 'industrial' test problem to be presented.

NTIS

Optimization; Sampling; Noise Tolerance; Simulation; Mathematical Models

19990106249 NASA Marshall Space Flight Center, Huntsville, AL USA

Experimental Study of Dust Grain Charging

Spann, James F, NASA Marshall Space Flight Center, USA; Venturini, Catherine C., Alabama Univ., USA; Comfort, Richard H., Alabama Univ., USA; Mian, Abbas M., NASA Marshall Space Flight Center, USA; May 24, 1999; In English; 2nd Physics of Dusty Plasmas, Kanagawa, Japan; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The results of an experimental study of the charging mechanisms of micron size dust grains are presented. Individual dust grains are electrodynamically suspended and exposed to an electron beam of known energy and flux, and to far ultraviolet radiation of known wavelength and intensity. Changes in the charge-to-mass ratio of the grain are directly measured as a function of incident beam (electron and/or photon), grain size and composition. Comparisons of our results to theoretical models that predict the grain response are presented.

Author

Dust; Experimentation; Charge Carriers; Grain Size

19990106254 Sandia National Labs., Albuquerque, NM USA

Adaptive Mesh Refinement in CTH

Crawford, D.; May 04, 1999; 8p; In English; 15th; 15th Solid Mechanics, 12-14 Apr. 1999, Myrtle Beach, SC, USA; Sponsored by Department of the Army, USA

Report No.(s): DE00-007235; SAND99-1118C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

This paper reports progress on implementing a new capability of adaptive mesh refinement into the Eulerian multimaterial shock-physics code CTH. The adaptivity is block-based with refinement and unrefinement occurring in an isotropic 2:1 manner. The code is designed to run on serial, multiprocessor and massive parallel platforms. An approximate factor of three in memory and performance improvements over comparable resolution non-adaptive calculations has-been demonstrated for a number of problems.

NTIS

Multiprocessing (Computers); Isotropy; Computational Grids

Includes sound generation, transmission and attenuation. For noise pollution see 45 Environmental Pollution.

19990099369 Leeds Univ., Inst. for Transport Studies, UK

Noise and Air Quality Valuations: Evidence From Stated Preference Residential and Business Choice Models

Wardman, M., Leeds Univ., UK; Bristow, A. L., Leeds Univ., UK; Hodgson, F. C., Leeds Univ., UK; The Conference Proceedings of the 1998 Air Transport Research Group (ATRG) of the WCTR Society; December 1998; Volume 4; 22p; In English
Contract(s)/Grant(s): ERSRC-GR/K-64181; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

It is increasingly recognized that the relationship between land use and transport planning is crucial to the development of sustainable integrated policies for cities. However, understanding of the impacts of transport policies on location choice and land use is limited. This paper reports on one aspect of a study funded by the Engineering and Physical Sciences Research Council under-taken by the Institute for Transport Studies in collaboration with The MVA Consultancy and the David Simmonds Consultancy, which aimed to improve understanding of this relationship. The principal objectives of this study were: (1) to increase our understanding of the impact of accessibility and environmental quality on individuals' and firms' location decisions; (2) to use the findings of (1) to enhance a newly developed strategic transport and land use interaction model; (3) to use the enhanced model to assess the implications for urban sustainability of the impact of transport policy on location choice; and (4) to use the enhanced model to assess the relative performance of different combinations of transport and land use strategy. The research fell into two main categories; the survey work and analysis undertaken to increase our understanding of the influence of environmental and accessibility factors in location choice and the other main strands of work relating to model enhancement and strategy testing, reported in a companion paper. The focus of this paper is on the valuation of environmental attributes. In the next section we discuss the development of our methodology and the survey implementation. Sections 3 and 4 examines the results in terms of perceptions and attitudes and also the outcome of a willingness to pay question. Sections 5 and 6 contains the main analysis and results of the household and business stated preference surveys. Concluding remarks are provided in Section 7.
Author
Environmental Quality; Noise (Sound); Air Quality; Planning; Policies

19990102038 Department of the Navy, Washington, DC USA
Low Voltage Power System for a Towed Acoustic Array
Dussault, Douglas G., Inventor; McKay, Donald W., Inventor; Simard, Maurice E., Inventor; May 21, 1999; 9p; In English
Patent Info.: Filed 21 May 99,; US-Patent-Appl-SN-09/317,090
Report No.(s): AD-D019432; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

A low voltage power system for a towed active array sonar is provided. The low voltage power system includes a shipside power supply driving a step up transformer which is connected to the tow cable transmission line. The transmission line is connected to a second step up transformer which provides the signal voltage to the active transducer. The transducer signal voltage is also used to drive a rectifier and DC power supply which provides DC bias voltage to the transducer. The DC voltage is isolated from the tow cable by a blocking capacitor.
DTIC
Towed Bodies; Sound Generators; Space Station Power Supplies; Spacecraft Power Supplies; Patent Applications; Technology Utilization

19990102912 Physics and Electronics Lab. TNO, Physics and Electronics Lab., The Hague, Netherlands
Acoustic "sniper" Localization *Final Report Akoestische 'Sniper' Lokalisering*
vanHoof, H. A. J. M., Physics and Electronics Lab. TNO, Netherlands; vanVoorthuijsen, G. P., Physics and Electronics Lab. TNO, Netherlands; April 1999; 88p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): TNO Proj. 26296; A96/KL/717
Report No.(s): TD99-0213; TNO-FEL-99-A069; Copyright; Avail: Issuing Activity, Hardcopy

A microphone array, existing of four microphones, and signal processing software have been designed and implemented for use on top of a vehicle. The equipment was meant to localize snipers by measuring and comparing times of arrival of the shock wave and the muzzle blast sound.
Author
Design Analysis; Computer Programs; Signal Processing

Rutherford Appleton Lab., Chilton UK
Some Noise Calculations for Time Invariant Filters
Seller, P.; Jan. 18, 1999; 60p
Report No.(s): PB99-129496; RAL-TR-1998-086; Copyright; Avail: National Technical Information Service (NTIS), Microfiche
  This paper presents the noise calculations for some detector readout circuits following the method outlined. The calculations of the thermal, shot and flicker noise for each filter are given. The calculations are performed in the time domain and then repeated in the frequency domain.
NTIS
Noise (Sound); Computation; Time Domain Analysis; Time Functions

72
ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

NASA Goddard Space Flight Center, Greenbelt, MD USA
Super Photon Counters
Mather, John, NASA Goddard Space Flight Center, USA; [1999]; 2p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
  The perfect photon detector would measure the arrival time, the energy, the polarization, and the position of every arriving quantum, but that is easier said than done. Two groups have now succeeded in doing time-resolved spectroscopy on the Crab Nebula pulsar, measuring everything but the polarization, with reports from Romani et al. at Stanford and from Perryman et al. at ESTEC. Both groups use superconducting detectors to gain the necessary speed and sensitivity. The photon can heat the electrons in a superconductor biased in the middle of its resistive transition, or break bound superconducting electron-hole pairs, which can then be collected. Three years ago, Peacock et al. reported that they had detected single optical photons with a superconducting tunnel junction (STJ), and Paresce wrote a News and Views article. A tunnel junction uses two pieces of conductive material, separated by a tiny gap of insulating material or even vacuum. If the gap is thin enough, electrons can tunnel across anyway, and if the conductors are superconductors, the junction displays very useful quantum mechanical properties and electrical nonlinearities. Amplifiers, detectors, oscillators, and computer circuits can all be made from them. Their special advantage is that they operate at very low temperatures, dissipate very little power, operate very fast, and are very small.
Derived from text
Counters; Photons; Time Measurement; Engine Monitoring Instruments; Polarization (Charge Separation)

Army Research Lab., Human Research and Engineering Directorate, Aberdeen Proving Ground, MD USA
Near-Neighbor Calculations Using a Modified Cell-Linked List Method *Final Report, Jan. 1997 - May 1998*
Mattson, William; Rice, Betsy M.; Jun. 1999; 53p; In English
Report No.(s): AD-A364892; ARL-TR-1956; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche
  We have modified the conventional cell-linked list method to reduce the number of unnecessary internuclear distance calculations in molecular simulations of systems containing many particles. In the conventional method, the simulation space is partitioned into cells with edge lengths no less than the cutoff distance of the interaction potential (r sub cut). The atoms are assigned to cells according to their spatial positions, and all internuclear distances for atoms within a cell and atoms in the same and nearest neighbor cells are evaluated. While this method ensures that the internuclear separation between all atom pairs within (r sub cut) is calculated, it allows for unnecessary internuclear distance calculations between pairs that are within the volume encompassing the neighbor cells but that are separated by more than (r sub cut). The modified method presented here allows for reductions in the cell sizes and the number of atoms within the volume encompassing the neighbor cells. These reductions decrease the number of atoms that are outside of the interaction range and the number of unnecessary internuclear distance calculations while ensuring that all internuclear distances within the cutoff range are evaluated. We present algorithms to determine the volume with the minimum number of neighbor cells as a function of cell size and the identities of the neighboring cells. We also evaluate the serial performance using the modified form as functions of cell size and particle density for comparison with the performance using the conventional cell-linked list method.
DTIC
Internuclear Properties; Molecular Structure; Molecular Dynamics; Atomic Energy Levels; Algorithms

19990102040 Department of Energy, Washington, DC USA

EM-PIC simulations of e-beam interaction with field emitted ions from bremsstrahlung targets

Rambo, P.; Aug. 13, 1998; 6p; In English; 19th; International linac conference

Report No.(s): DE98-058638; UCRL-JC-130469; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

We investigate electron beam defocusing caused by field emitted ions from the bremsstrahlung target of a radiography machine using fully electromagnetic particle-in-cell simulations. This possibly deleterious effect is relevant to both current radiography machines (FXR) and machines being built (DARHT-2) or planned (AHF). A simple theory of the acceleration of ions desorbed from the heated target, and subsequent beam defocusing due to partial charge neutralization is in reasonable agreement with the more detailed simulations. For parameters corresponding to FXR (I_b=2.3 kA, ϵ_b=16 MeV), simulations assuming space-charge-limited emission of protons predict prompt beam defocusing. Time integrated spot-size measurement, however, is dominated by early-time small spot brightness, and so is not a sensitive diagnostic. Comparisons are made to available FXR data. We also investigate use of a recessed target geometry to mitigate field emitted ion acceleration; only modest improvements are predicted.

NTIS

Electron Beams; Emittance; Ions; Bremsstrahlung; Field Emission; Targets

19990102861 NASA Marshall Space Flight Center, Huntsville, AL USA

Observation of Individual Fluorine Atom from Highly Oriented Poly (tetrafluoroethylene) Films by Atomic Force Microscopy

Lee, Jonathan A.,, NASA Marshall Space Flight Center, USA; Paley, Mark S., NASA Marshall Space Flight Center, USA; [1999]; In English

Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Direct observation of the film thickness, molecular structure and individual fluorine atoms from highly oriented poly(tetrafluoroethylene) (PTFE) films were achieved using atomic force microscopy (AFM). A thin PTFE film is mechanically deposited onto a smooth glass substrate at specific temperatures by a friction transfer technique. Atomic resolution images of these films show that the chain-like helical structures of the PTFE macromolecules are aligned parallel to each other with an intermolecular spacing of 5.72 A, and individual fluorine atoms are clearly observed along these twisted molecular chains with an interatomic spacing of 2.75 A. Furthermore, the first direct AFM measurements for the radius of the fluorine-helix, and of the carbon-helix in sub-angstrom scale are reported as 1.70 A and 0.54 A respectively.

Author

Atoms; Film Thickness; Fluorine; Macromolecules; Molecular Chains; Molecular Structure

19990103060 National Renewable Energy Lab., Golden, CO USA

Sub-Picosecond Injection of Electrons from Excited (Ru (2,2'-bipy-4,4'- dicarboxy)2(SCN)2) into TiO2 Using Transient Mid-Infrared Spectroscopy

Nozik, A. J., National Renewable Energy Lab., USA; Ghosh, H. N., National Renewable Energy Lab., USA; Asbury, J. B., National Renewable Energy Lab., USA; Sprague, J. R., National Renewable Energy Lab., USA; Ellingson, R. J., National Renewable Energy Lab., USA; May 04, 1999; 12p; In English; 12th; International Conference on Photochemical Conversion and Storage of Solar Energy, 9-14 Aug. 1998, Berlin, Germany; Sponsored by Department of Energy, USA

Report No.(s): DE00-006899; NREL/CP-590-25519; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

We have used femtosecond pump-probe spectroscopy to time resolve the injection of electrons into nanocrystalline TiO2 film electrodes under ambient conditions following photoexcitation of the adsorbed dye, (Ru(4,4'-dicarboxy-2, 2'-bipyridine)2(NCS)2) (N3). Pumping at one of the metal-to-ligand charge transfer adsorption peaks and probing the absorption of electrons injected into the TiO2 conduction band at 1.52 m and in the range of 4.1 to 7.0 m, we have directly observed the arrival of the injected electrons. Our measurements indicate an instrument-limited ;50-fs upper limit on the electron injection time under ambient conditions in air. We have compared the infrared transient absorption for noninjecting (blank) systems consisting of N3 in ethanol and N3 adsorbed to films of nanocrystalline Al2O3 and ZrO2, and found no indication of electron injection at probe wavelengths in the mid-IR (4.1 to 7.0 m). At 1.52 m interferences exist in the observed transient adsorption signal for the blanks.

NTIS

Electron Transfer; Infrared Spectroscopy; Charge Transfer; Zirconium Oxides; Photoexcitation

19990103165 NASA Marshall Space Flight Center, Huntsville, AL USA

Fluorescence Studies of Lysozyme Nucleation

Pusey, Marc L., NASA Marshall Space Flight Center, USA; Smith, Lori, Alabama Univ., USA; 1998; 1p; In English; 7th; Crystal-

lization of Biological Macromolecules, 3 May 1998, Granada, Spain; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Fluorescence is one of the most powerful tools available for the study of macromolecules. For example, fluorescence can be used to study self association through methods such as anisotropy (the rotational rate of the molecule in solution), quenching (the accessibility of a bound probe to the bulk solution), and resonance energy transfer (measurement of the distance between two species). Fluorescence can also be used to study the local environment of the probe molecules, and the changes in that environment which accompany crystal nucleation and growth. However fluorescent techniques have been very much underutilized in macromolecular growth studies. One major advantage is that the fluorescent species generally must be at low concentration, typically ca 10-5 to 10-6 M. Thus one can study a very wide range of solution conditions, ranging from very high to very low protein concentration, he latter of which are not readily accessible to scattering techniques. We have prepared a number of fluorescent derivatives of chicken egg white lysozyme (CEWL). Fluorescent probes have been attached to two different sites, ASP 101 and the N-terrninal amine, with a sought for use in different lines of study. Preliminary resonance energy transfer studies have been carried out using pyrene acetic acid (Ex 340 mn, Em 376 nm) lysozyme as a donor and cascade blue (Ex 377 run, Em 423 nm) labeled lysozyme as an acceptor. The emission of both the pyrene and cascade blue probes was followed as a function of the salt protein concentrations. The data show an increase in cascade blue and a concomitant decrease in the pyrene fluorescence as either the salt or protein concentrations are increased, suggesting that the two species are approaching each other close enough for resonance energy transfer to occur. This data can be analyzed to measure the distance between the probe molecules and, knowing their locations on the protein molecule their distances from and orientations with respect to each other. The results of these and other studies will be discussed.
Author
Fluorescence; Research; Lysozyme; Nucleation

19990103365 Brookhaven National Lab., Physics Dept., Upton, NY USA
Parton structure through two particle correlations in Au-Au at RHIC
Longacre, R. S.; Dec. 31, 1998; 19p; In English
Report No.(s): DE99-002662; BNL-66425; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

A method for determining the presence of partonic scattering through two-particle correlations is developed and applied to models which have jets and mini-jets in them. The author only considers the correlation of mid-rapidity particles because they will be easily measured in large numbers at RHIC. The level of two-particle correlations will be a direct measure of how dense a system is made in Au-Au collisions at RHIC. The STAR TPC will be ideal for making these measurements in the first year of running.
NTIS
Correlation; Partons; Atomic Physics

19990103921 Los Alamos National Lab., NM USA
Determination of the effective delayed neutron fraction using MCNP4B
Werner, C. J.; Little, R. C.; Feb. 02, 1999; 5p; In English
Report No.(s): DE99-002744; LA-UR-99-629; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The capability to calculate effective delayed neutron fractions has now been implemented into MCNP4B and is in the testing phase. This option should prove to be most useful for multiplying systems which are not easily modeled using deterministic codes.
NTIS
Monte Carlo Method; Neutrons; Fractions; Computer Programs; Splitting

19990105889 Sandia National Labs., Albuquerque, NM USA
Synthesis, Characterization and Ion Exchange of New Na/Nb/M(4+)/O/H(2) O(M=Ti,Zr) Phases
Nenoff, T. M.; Nyman, M.; May 07, 1999; 13p; In English; Metals Separation Technologies Beyond 2000, Integrating Novel Chemistry with Processing, 13-19 Jun. 1999, Oahu, HI, USA
Report No.(s): DE00-007244; SAND99-1197C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Due to the vast diversity of chemical media in which metal separations are executed, a wide range of ion separation materials are employed. This results in an ongoing effort to discover new phases with novel ion exchange properties. We present here the synthesis of a novel class of thermally and chemically stable microporous, niobate-based materials. Ion exchange studies show these new phases are highly selective for SR<sup>2+</sup> and other bivalent metals.
NTIS
Synthesis (Chemistry); Ion Exchanging; Porous Materials; Inorganic Materials

Includes elementary and nuclear particles; and reactor theory. For space radiation see 93 Space Radiation.

19990100915 NASA Marshall Space Flight Center, Huntsville, AL USA
Antimatter Production for Near-Term Propulsion Applications
Schmidt, G. R., NASA Marshall Space Flight Center, USA; Gerrish, H. P., NASA Marshall Space Flight Center, USA; Martin, J. J., NASA Marshall Space Flight Center, USA; Smith, G. A., Pennsylvania State Univ., USA; Meyer, K. J., Pennsylvania State Univ., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The superior energy density of antimatter annihilation has often been pointed to as the ultimate source of energy for propulsion. However, the limited capacity and very low efficiency of present-day antiproton production methods suggest that antimatter may be too costly to consider for near-term propulsion applications. We address this issue by assessing the antimatter requirements for six different types of propulsion concepts, including two in which antiprotons are used to drive energy release from combined fission/fusion. These requirements are compared against the capacity of both the current antimatter production infrastructure and the improved capabilities which could exist within the early part of next century. Results show that although it may be impractical to consider systems which rely on antimatter as the sole source of propulsive energy, the requirements for propulsion based on antimatter-assisted fission/fusion do fall within projected near-ten-n production capabilities. In fact, such systems could feasibly support interstellar precursor missions and omniplanetary spaceflight with antimatter costs ranging up to $60 million per mission.
Author
Annihilation Reactions; Antimatter; Antiprotons; Fission; Matter-Antimatter Propulsion

19990102048 Department of Energy, Office of Energy Research, Washington, DC USA
Measurement of the mass of the W boson from the Tevatron
Thurman–Keup, R.; Aug. 31, 1998; 16p; In English; 2nd; SILAFAE 1998: Particle and high energy physics
Report No.(s): DE98-058032; FNAL/C-98/228-E; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

This paper presents measurements of the mass of the W vector boson from the CDF and D0 experiments using data collected at (radical)s = 1.8 TeV during the 1994-1995 data taking run. CDF finds a preliminary mass of $M(sub W) = 80.43$ (+/-) 0.16 GeV and D0 measures a mass of $M(sub W) = 80.44$ (+/-) 0.12 GeV.
NTIS
Bosons; Nuclear Physics

19990102899 Los Alamos National Lab., NM USA
Lepton family number violation
Herczeg, P.; Dec. 31, 1999; 17p; In English
Report No.(s): DE99-002012; LA-UR-99-293; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

At present there is evidence from neutrino oscillation searches that the neutrinos are in fact massive particles and that they mix. If confirmed, this would imply that the conservation of LFN is not exact. Lepton family number violation (LFNV) has been searched for with impressive sensitivities in many processes involving charged leptons. The present experimental limits on some of them (those which the author shall consider here) are shown in Table 1. These stringent limits are not inconsistent with the neutrino oscillation results since, given the experimental bounds on the masses of the known neutrinos and the neutrino mass squared differences required by the oscillation results, the effects of LFNV from neutrino mixing would be too small to be seen elsewhere. The purpose of experiments searching for LFNV involving the charged leptons is to probe the existence of other sources of LFNV. Such sources are present in many extensions of the SM. In this lecture the author shall discuss some of the possibilities, focusing on processes that require muon beams. Other LFNV processes, such as the decays of the kaons and of the (tau), provide complementary information. In the next Section he shall consider some sources of LFNV that do not require an extension of the gauge group of the SM (the added leptons or Higgs bosons may of course originate from models with extended gauge groups). In Section 3 he discusses LFNV in left-right symmetric models. In Section 4 he considers LFNV in supersymmetric models, first in R- parity conserving supersymmetric grand unified models, and then in the minimal supersymmetric standard model with R-parity violation. The last section is a brief summary of the author's conclusions.
NTIS
Nuclear Physics; Leptons

Los Alamos National Lab., Physics Div., NM USA

Tests of CPT, Lorentz invariance and the WEP with antihydrogen

Holzscheiter, M. H.; Dec. 31, 1999; 12p; In English; CPT and Lorentz symmetry

Report No.(s): DE99-002006; LA-UR-99-231; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Antihydrogen atoms, produced near rest, trapped in a magnetic well, and cooled to the lowest possible temperature (kinetic energy) could provide an extremely powerful tool for the search of violations of CPT and Lorentz invariance. Equally well, such a system could be used for searches of violations of the Weak Equivalence Principle (WEP) at high precision. The author describes his plans to form a significant number of cold, trapped antihydrogen atoms for comparative precision spectroscopy of hydrogen and antihydrogen and comment on possible first experiments.

NTIS

Hydrogen; Equivalence; Antimatter; Lorentz Transformations; Invariance; Nuclear Physics

Los Alamos National Lab., Physics Div., NM USA

Bose-Einstein correlations and the equation of state of nuclear matter in relativistic heavy-ion collisions

Schlei, B. R.; Dec. 31, 1998; 9p; In English; 8th; Multiparticle production: Correlation and fluctuations 1998

Report No.(s): DE99-002610; LA-UR-98-3788; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Experimental spectra of the CERN/SPS experiments NA44 and NA49 are fitted while using four different equations of state of nuclear matter within a relativistic hydrodynamic framework. For the freeze-out temperatures, $T_f = 139$ MeV and $T_f = 116$ MeV, respectively, the corresponding freeze-out hypersurfaces and Bose-Einstein correlation functions for identical pion pairs are discussed. It is concluded, that the Bose-Einstein interferometry measures the relation between the temperature and the energy density in the equation of state of nuclear matter at the late hadronic stage of the fireball expansion. It is necessary, to use the detailed detector acceptances in the calculations for the Bose-Einstein correlations.

NTIS

Correlation; Equations of State; Matter (Physics); Ionic Collisions; Heavy Ions; Nuclear Physics; Bose-Einstein Condensates

Los Alamos National Lab., NM USA

SQUIDs as detectors in a new experiment to measure the neutron electric dipole moment

Espy, M. A.; Cooper, M.; Lamoreaux, S.; Kraus, R. H.; Matlachov, A.; Dec. 31, 1998; 5p; In English; Applied superconductivity

Report No.(s): DE99-002588; LA-UR-98-3894; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

A new experiment has been proposed at Los Alamos National Laboratory to measure the neutron electric dipole moment (EDM) to 4×10^{-28} ecm, a factor of 250 times better than the current experimental limit. Such a measure of the neutron EDM would challenge the theories of supersymmetry and time reversal violation as the origin of the observed cosmological asymmetry in the ratio of baryons to antibaryons. One possible design for this new experiment includes the use of LTC SQUIDs coupled to large ((approximately)100 cm^2)) pick-up coils to measure the precision frequency of the spin-polarized He-3 atoms that act as polarizer, spin analyzer, detector, and magnetometer for the ultra-cold neutrons used in the experiment. The method of directly measuring the He-3 precession signal eliminates the need for very uniform magnetic fields (a major source of systematic error in these types of experiments). It is estimated that a flux of (approximately)2×10^{-16} Tm^2 ($0.1 \Phi_0$) will be coupled into the pick-up coils. to achieve the required signal-to-noise ratio one must have a flux resolution of $d\Phi_{SQ} = 2 \times 10^{-6} \Phi_0/\sqrt{Hz}$ at 10 Hz. While this is close to the sensitivity available in commercial devices, the effects of coupling to such a large pick-up coil and flux noise from other sources in the experiment still need to be understood. To determine the feasibility of using SQUIDs in such an application the authors designed and built a superconducting test cell, which simulates major features of the proposed EDM experiment, and they developed a two-SQUID readout system that will reduce SQUID noise in the experiment. They present an overview of the EDM experiment with SQUIDs, estimations of required SQUID parameters and experimental considerations. The authors also present the measured performance of a single magnetometer in the test cell as well as the performance of the two SQUID readout technique.

NTIS

Nuclear Physics; Squid (Detectors); Dipole Moments; Electric Dipoles; Cold Neutrons

Los Alamos National Lab., NM USA

Measurement of neutron attenuation through thick shields and comparison with calculation

Bull, J. S.; Donahue, J. B.; Burman, R. L.; Dec. 31, 1998; 9p; In English; 4th; Workshop on simulating accelerator radiation environments

Report No.(s): DE99-002559; LA-UR-98-3977; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The large neutrino experiments conducted over the last several years at the Los Alamos Neutron Science Center (LANSCE) have provided the opportunity to measure the effects of neutron attenuation in very thick shields. These experiments have featured detectors with active masses of 6 to 150 tons and shield thicknesses ranging from 3000 to 5280 g/cm(exp 2). An absolute measurement of the high-energy neutron flux was made from the beam stop in a neutrino cave at ninety degrees and nine meters from the beam stop. Differential neutron shielding measurements in iron were also performed, resulting in an attenuation length of 148 g/cm(exp 2). These measurements allow for the testing of radiation shielding codes for deep penetration problems. The measured flux and attenuation length is compared to calculations using the LAHET Code System (LCS). These codes incorporate biasing techniques, allowing for direct calculation of deep penetration shielding problems. Calculations of the neutron current and attenuation length are presented and compared with measured values. Results from the shielding codes show good agreement with the measured values.

NTIS

Neutrons; Attenuation Coefficients; Radiation Shielding; Nuclear Physics

19990103374 Los Alamos National Lab., NM USA
Application of a generalized interface module to the coupling of PARCS with both RELAP5 and TRAC-M
Barber, D. A.; Wang, W.; Miller, R. M.; Downar, T. J.; Joo, H. G.; Dec. 31, 1999; 7p; In English
Report No.(s): DE99-002742; LA-UR-99-856; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In an effort to more easily assess various combinations of 3-D neutronic/ thermal-hydraulic codes, the USNRC has sponsored the development of a generalized interface module for the coupling of any thermal-hydraulics code to any spatial kinetics code. In this design, the thermal-hydraulics, general interface, and spatial kinetics codes function independently and utilize the Parallel Virtual Machine (PVM) software to manage inter-process communication. Using this interface, the USNRC version of the 3D neutron kinetics code, PARCS, has been coupled to the USNRC system analysis codes RELAP5 and TRAC-M. RELAP5/PARCS assessment results are presented for an OECD/NEA main steam line break benchmark problem. The assessment of TRAC-M/PARCS has only recently been initiated; nonetheless, the capabilities of the coupled code are presented for the OECD/NEA main steam line break benchmark problem.

NTIS

Nuclear Reactors; Systems Analysis; Computer Programs; Neutrons

19990103375 Los Alamos National Lab., NM USA
Determination of proton and neutron spectra in the LANSCE spallation irradiation facility
James, M. R.; Maloy, S. A.; Sommer, W. F.; Fowler, M. M.; Dry, D.; Dec. 31, 1999; 4p; In English
Report No.(s): DE99-002743; LA-UR-99-604; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Materials samples were recently irradiated in the Los Alamos Radiation Effects Facility (LASREF) at the Los Alamos Neutron Science Center (LANSCE) to provide data for the Accelerator Production of Tritium (APT) project on the effect of irradiation on the mechanical and physical properties of materials. The targets were configured to expose samples to a variety of radiation environments including, high-energy protons, mixed protons and high-energy neutrons, and low-energy neutrons. The samples were irradiated for approximately six months during a ten month period using an 800 MeV proton beam with a circular Gaussian shape of approximately 2(sigma) = 3.0 cm. At the end of this period, the samples were extracted and tested. Activation foils were also extracted that had been placed in proximity to the materials samples. These were used to quantify the fluences in various locations.

NTIS

Irradiation; Radiation Effects; Neutron Spectra; Spallation

19990103922 Los Alamos National Lab., NM USA
User's information for the Monte Carlo burnup code monteburns
Trellue, H. R.; Poston, D. I.; Jan. 31, 1999; 3p; In English
Report No.(s): DE99-002747; LA-UR-99-41; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

A monteburns, a burnup computer code that uses the Monte Carlo technique, was developed at Los Alamos National Laboratory to be applied to a variety of nuclear design calculations (see accompanying paper on the development of monteburns). It is a fully automated burnup code that incorporates multiple irradiation steps and many other options. However, two of the most important aspects of developing a code are describing how to use it and benchmarking it. Thus, the operational aspects and benchmarking results from monteburns are discussed in this summary.

NTIS

Computer Programs; Irradiation; Monte Carlo Method

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Los Alamos National Lab., NM USA

Testing capabilities of Los Alamos National Laboratory for irradiated materials

Maloy, S. A.; James, M. R.; Sommer, W. F.; Dec. 31, 1999; 4p; In English

Report No.(s): DE99-002748; LA-UR-99-603; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Spallation neutron sources expose materials to high energy proton and neutron spectra. Although numerous studies have investigated the effects of radiation damage in a lower energy neutron flux from fission or fusion reactors on the mechanical properties of materials, very little work has been performed on the effects that exposure to a spallation neutron spectrum has on the mechanical properties of materials. These effects can be significantly different than those observed in a fission or fusion reactor spectrum because exposure to high energy protons and neutrons produces more He and H along with the atomic displacement damage. Los Alamos National Laboratory has unique facilities to study the effects of spallation radiation damage on the mechanical properties of materials. The Los Alamos Neutron Science Center (LANSCE) has a pulsed linear accelerator which operates at 800 MeV and 1 mA. The Los Alamos Spallation Radiation Effect Facility (LASREF) located at the end of this accelerator is designed to allow the irradiation of components in a proton beam while water cooling these components and measuring their temperature. After irradiation, specimens can be investigated at hot cells located at the Chemical Metallurgy Research Building. Wing 9 of this facility contains 16 hot cells set up in two groups of eight, each having a corridor in the center to allow easy transfer of radioactive shipments into and out of the hot cells. These corridors have been used to prepare specimens for shipment to collaborating laboratories such as PNNL, ORNL, BNL, and the Paul Scherrer Institute to perform specialized testing at their hot cells. The LANL hot cells contain capabilities for opening radioactive components and testing their mechanical properties as well as preparing specimens from irradiated components.

NTIS

Neutron Sources; Radiation Effects; Mechanical Properties; Performance Tests; Irradiation; Fusion Reactors; Radioactivity; Spallation

Los Alamos National Lab., NM USA

Recent developments in the accelerator design code PARMILA

Takeda, H.; Billen, J. H.; Dec. 31, 1998; 3p; In English; 19th; International linac conference

Report No.(s): DE99-002758; LA-UR-98-3657; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The PARMILA code, which originated in the 1960s for designing drift-tube linacs (DTLs), now designs and simulates the performance of many types of rf linear accelerator. The structure types include the DTL, coupled-cavity drift- tube linac (CCDTL), conventional coupled-cavity linac (CCL), and several types of superconducting linac. This new code can handle multiple types of linac structures in a single run. This code features a more logically organized input sequence for the different linac structures and their properties. A PARMILA run can include sequences of beam-transport elements. In this paper, the authors describe the new user interface, highlighting the implementation of multiple rf structures. Also, they discuss the algorithm used for designing superconducting linac structures.

NTIS

Computer Programs; Linear Accelerators; Superconducting Devices; Computer Aided Design; Superconducting Magnets; Radio Frequencies

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OPTICS

</div>

Includes light phenomena; and optical devices. For lasers see 36 Lasers and Masers.

NASA Marshall Space Flight Center, Huntsville, AL USA

Near Simultaneous Spectroscopic and Polarimetric Observations of Be Stars

Ghosh, K. K., NASA Marshall Space Flight Center, USA; Iyenger, K. V. K., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Austin, R. A., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Near simultaneous optical spectroscopic (on four nights) and linear continuum (B, V, R and I bands) polarimetric (on seven nights) observations of 29 Be stars were carried out during November - December 1993. The program Be stars displayed wavelength dependence of intrinsic polarizations with no frequency dependence of position angles. Measured values of linear intrinsic polarizations of these Be stars were all less than 1.6%. The Be and Be-shell stars displayed no clear distinction in their polarization values. Observed polarizations at B, V, R and I bands were compared with the theoretically computed linear polarization values of the program stars. It has been suggested that these observed polarizations indicate that the envelopes of the Be stars may have

a range of oblateness. Early-type Be stars displayed relatively higher polarizations than the late-type ones. Full widths at half intensity maximum of H(sub alpha) profiles and the intrinsic linear continuum polarizations are closely correlated with the projected rotational velocities of the program stars. Photospheric-absorption-corrected equivalent widths of H(sub alpha), profiles [W((alpha)] and the radii of H(sub alpha) emitting envelopes (R(sub e)) are non-linearly correlated with the intrinsic continuum polarizations of these stars. However, W((alpha) and R(sub e) are linearly correlated. Detail discussion of these results are presented in this paper.

Author

B Stars; Polarization Characteristics; Oblate Spheroids

19990102223 NASA Marshall Space Flight Center, Huntsville, AL USA

Calibration Results for the AXAF Flux Contamination Monitor

Elsner, R. F., NASA Marshall Space Flight Center, USA; ODell, S. L., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Tennant, A. F., NASA Marshall Space Flight Center, USA; Weisskopf, M. C., NASA Marshall Space Flight Center, USA; Kolodziejczak, J. J., NASA Marshall Space Flight Center, USA; Swartz, D. A., NASA Marshall Space Flight Center, USA; Engelhaopt, D., NASA Marshall Space Flight Center, USA; Garmire, G., NASA Marshall Space Flight Center, USA; Nousek, J., NASA Marshall Space Flight Center, USA; Bautz, M., NASA Marshall Space Flight Center, USA; 1998; In English, Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The AXAF Flux Contamination Monitor (FCM) serves the purposes of transferring the absolute flux calibration from the ground calibration at the X-Ray Calibration Facility (XRCF) to operation on orbit and of detecting any changes in molecular contamination of the High-Resolution Mirror Assembly (HRMA) between ground calibration and the post-launch activation. We describe the design, construction, and characterization of the FCM radioactive sources, and their placement on the Forward Contamination Cover (FCC). We present results from FCM measurements with the AXAF focal-plane instruments, particularly the AXAF CCD Imaging Spectrometer (ACIS), during the ground calibration phase at the XRCF in 1997. Finally, we describe the plans for FCM on-orbit measurements during observatory activation and for the subsequent analysis.

Author

Calibrating; Contamination; Molecular Dynamics; Mirrors; Focusing; Detection

19990103079 NASA Goddard Inst. for Space Studies, New York, NY USA

Bidirectional Reflectance of Flat, Optically Thick Particulate Layers: An Efficient Radiative Transfer Solution and Applications to Snow and Soil Surfaces

Mishchenko, Michael I., NASA Goddard Inst. for Space Studies, USA; Dlugach, Janna M., Main Astronomical Observatory, Ukraine; Yanovitsku, Edgard G., Main Astronomical Observatory, Ukraine; Zakharova, Nadia T., Science Systems and Applications, Inc., USA; [1999]; 42p; In English

Report No.(s): GCN-99-38; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We describe a simple and highly efficient and accurate radiative transfer technique for computing bidirectional reflectance of a macroscopically flat scattering layer composed of nonabsorbing or weakly absorbing, arbitrarily shaped, randomly oriented and randomly distributed particles. The layer is assumed to be homogeneous and optically semi-infinite, and the bidirectional reflection function (BRF) is found by a simple iterative solution of the Ambartsumian's nonlinear integral equation. As an exact Solution of the radiative transfer equation, the reflection function thus obtained fully obeys the fundamental physical laws of energy conservation and reciprocity. Since this technique bypasses the computation of the internal radiation field, it is by far the fastest numerical approach available and can be used as an ideal input for Monte Carlo procedures calculating BRFs of scattering layers with macroscopically rough surfaces. Although the effects of packing density and coherent backscattering are currently neglected, they can also be incorporated. The FORTRAN implementation of the technique is available on the World Wide Web at http://ww,,v.giss.nasa.gov/-crmim/brf.html and can be applied to a wide range of remote sensing, engineering, and biophysical problems. We also examine the potential effect of ice crystal shape on the bidirectional reflectance of flat snow surfaces and the applicability of the Henyey-Greenstein phase function and the 6-Eddington approximation in calculations for soil surfaces.

Author

Bidirectional Reflectance; Flat Layers; Ice; Iterative Solution; Radiation Distribution; Radiative Transfer; Scattering

19990103094 NASA Goddard Space Flight Center, Greenbelt, MD USA

Broadband Infrared Antireflection Structured Silicon Surfaces

Stewart, Kenneth, NASA Goddard Space Flight Center, USA; Fettig, Rainer, NASA Goddard Space Flight Center, USA; Allen, Christine, NASA Goddard Space Flight Center, USA; Larocque, Jennifer, NASA Goddard Space Flight Center, USA; 1999; In

English, 20-26 Mar. 1999, Atlanta, GA, USA; Sponsored by American Physical Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Silicon and germanium are materials often used for infrared (IR) windows and optical elements. However they have a very high index of refraction, in the order of three to four, which causes large reflection losses on each surface. These losses are especially high under large angles of incidence which are often desirable if signals are faint and fast optics are to be used. Solid antireflection coatings are either not available because materials with appropriate index of refraction do not exist, or their use is limited to a small wavelength range and small angles of incidence. We will present the status of our work to calculate, create, and test the performance of graded structures in Si to reduce its surface reflection. The structures are expected to work over the very broad wavelength range of 10 micron to 1000 micron and a wide range of angle of incidence. We.have identified several high aspect ratio MEMS process techniques to create the structures and have done 3D electromagnetic modeling, which predicts significant effects. Measurements on different samples have validated our modeling.
Author
Antireflection Coatings; Germanium; Infrared Windows; Silicon; Refractivity

19990103358 NASA Goddard Inst. for Space Studies, New York, NY USA
Light Scattering by Nonspherical Particles
Mishchenko, Michael I., NASA Goddard Inst. for Space Studies, USA; Travis, Larry D., NASA Goddard Inst. for Space Studies, USA; Hovenier, Joop W., Amsterdam Univ., Netherlands; [1998]; 6p; In English
Report No.(s): GCN-99-39; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Improved understanding of electromagnetic scattering by nonspherical particles is important to many science and engineering disciplines and was the subject of the Conference on Light Scattering by Nonspherical Particles: Theory, Measurements, and Applications. The conference was held 29 September-1 October 1998 at the Goddard Institute for Space Studies in New York City and brought together 115 participants from 18 countries. The main objective of the conference was to highlight and summarize the rapid advancements in the field, including numerical methods for computing the single and multiple scattering of electromagnetic radiation by nonspherical and heterogeneous particles, measurement approaches, knowledge of characteristic features in scattering patterns, retrieval and remote sensing techniques, nonspherical particle sizing, and various practical applications. The conference consisted of twelve oral and one poster sessions. The presentations were loosely grouped based on broad topical categories. In each of these categories invited review talks highlighted and summarized specific active areas of research. to ensure a high-quality conference, all abstracts submitted had been reviewed by members of the Scientific Organizing Committee for technical merit and content. The conference program was published in the June 1998 issue of the Bulletin of the American Meteorological Society and is available on the World Wide Web at http://www.giss.nasa.gov/-crmim/conference/program.html. Authors of accepted papers and review presentations contributed to a volume of preprints published by the American Meteorological Society' and distributed to participants at the conference.
Derived from text
Light Scattering; Numerical Analysis; Computation; Electromagnetic Radiation

19990104279 NASA Lewis Research Center, Cleveland, OH USA
Optical Power Source Derived from Engine Combustion Chambers
Baumbick, Robert J., Inventor, NASA Lewis Research Center, USA; Jul. 13, 1999; In English
Patent Info.: Filed 2 Feb. 1998; NASA-Case-LEW-16542-1; US-Patent-5,923,809; US-Patent-Appl-SN-040194; No Copyright; Avail: US Patent and Trademark Office, Hardcopy

An optical power source is disclosed that collects the spectra of the light emissions created in a combustion chamber to provide its optical output signals that serve the needs of optical networks. The light spectra is collected by a collection ring serving as an optical waveguide.
Author
Optical Waveguides; Light Beams; Light Emission; Laser Outputs; Optical Communication

19990104335 NASA Marshall Space Flight Center, Huntsville, AL USA
Fresnel Lens Solar Concentrator Design Based on Geometric Optics and Blackbody Radiation Equations
Watson, Michael D., NASA Marshall Space Flight Center, USA; Jayroe, Robert, NASA Marshall Space Flight Center, USA; 1998; 1p; In English; International Solar Energy Conference, 13-19 Jun. 1998, Albuquerque, NM, USA; Sponsored by American Society of Mechanical Engineers, USA; Meeting sponsored in part by AIA; No Copyright; Avail: Issuing Activity (NASA, Marshall Space Flight Center, Huntsville, AL); Abstract Only, Hardcopy, Microfiche

Fresnel lenses have been used for years as solar concentrators in a variety of applications. Several variables effect the final design of these lenses including: lens diameter, image spot distance from the lens, and bandwidth focused in the image spot. Defining the image spot as the geometrical optics circle of least confusion, a set of design equations has been derived to define the groove angles for each groove on the lens. These equations allow the distribution of light by wavelength within the image spot to be calculated. Combining these equations with the blackbody radiation equations, energy distribution, power, and flux within the image spot can be calculated. In addition, equations have been derived to design a lens to produce maximum flux in a given spot size. Using these equations, a lens may be designed to optimize the spot energy concentration for given energy source.
Author
Lens Design; Black Body Radiation; Fresnel Lenses; Geometrical Optics

19990105701 NASA Marshall Space Flight Center, Huntsville, AL USA
Thermal Analysis of a Finite Element Model in a Radiation Dominated Environment
Page, Arhur T., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 10th; Thermal and Fluids Analysis, 13-17 Sep. 1999, Huntsville, AL, USA
Contract(s)/Grant(s): RTOP 839-06-70-00-ED; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
This paper presents a brief overview of thermal analysis, evaluating the University of Arizona mirror design, for the Next Generation Space Telescope (NGST) Pre-Phase A vehicle concept. Model building begins using Thermal Desktop(Tm), by Cullimore and Ring Technologies, to import a NASTRAN bulk data file from the structural model of the mirror assembly. Using Auto-CAD(R) capabilities, additional surfaces are added to simulate the thermal aspects of the problem which, for due reason, are not part of the structural model. Surfaces are then available to accept thermophysical and thermo-optical properties. Thermal Desktop(Tm) calculates radiation conductors using Monte Carlo simulations. Then Thermal Desktop(Tm) generates the SINDA/Fluint input file having a one-to-one correspondence with the NASTRAN node and element definitions. A model is now available to evaluate the mirror design in the radiation dominated environment conduct parametric trade studies of the thermal design, and provide temperatures to the finite element structural model.
Author
Thermal Analysis; Finite Element Method; Mirrors; Design Analysis; Mathematical Models

19990105738 Colorado Univ., Boulder, CO USA
[Build and Demonstrate a X-Ray Interferometer and Build and Fly a High Resolution Telescope on a Sounding Rocket}
Final Report
Mar. 31, 1999; 4p; In English
Contract(s)/Grant(s): NAG5-5020; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche
This report is written with eight months still go on the 36 month period of the grant. This grant, as originally proposed three years ago, was two pronged - to build and demonstrate a practical x-ray interferometer, and to build and fly a high resolution telescope on a sounding rocket. As we started into these projects, we received community feedback that led to our giving priority to the interferometer., The rocket would achieve O.2-arcsecond resolution that, while better, than that of Chandra, would, because of the limited signal of a sub-orbital flight, not be of substantially greater scientific use. The interferometry, on the other hand, shows the potential for many orders of magnitude improvement. For this reason we gave priority to the lab interferometry, and the building of the telescope lagged behind. With our new understanding (and practical demonstration) of how to build an interferometer, we changed the telescope design from spherical surfaces in the Kirkpatrick-Baez configuration, to an interferometer with resolution between .005 and .05 arcseconds.
Derived from text
Interferometers; Interferometry; X Rays; Mirrors; Charge Coupled Devices

19990106252 NASA Marshall Space Flight Center, Huntsville, AL USA
Absolute Calibration of the AXAF Telescope Effective Area
Kellogg, E., NASA Marshall Space Flight Center, USA; Cohen, L., NASA Marshall Space Flight Center, USA; Edgar, R., NASA Marshall Space Flight Center, USA; Evans, I., NASA Marshall Space Flight Center, USA; Freeman, M., NASA Marshall Space Flight Center, USA; Gaetz, T., NASA Marshall Space Flight Center, USA; Jerius, D., NASA Marshall Space Flight Center, USA; McDermott, W. C., NASA Marshall Space Flight Center, USA; McKinnon, P., NASA Marshall Space Flight Center, USA; Murray, S., NASA Marshall Space Flight Center, USA; Podgorski, W., NASA Marshall Space Flight Center, USA; Schwartz, D., NASA Marshall Space Flight Center, USA; VanSpeybroeck, L., NASA Marshall Space Flight Center, USA; Wargelin, B., NASA Marshall Space Flight Center, USA; Zombeck, M., NASA Marshall Space Flight Center, USA; Weisskopf, M., NASA Marshall Space Flight Center, USA; Elsner, R., NASA Marshall Space Flight Center, USA; ODell, S., NASA Marshall Space Flight Center,

USA; Tennant, A., NASA Marshall Space Flight Center, USA; Kolodziejczak, J., NASA Marshall Space Flight Center, USA; Bulletin of the American Astronomical Society; 1997; Volume 3113, pp. 515-525; In English; No Copyright; Avail: Issuing Activity (NASA, Marshall Space Flight Center, Huntsville, AL); Abstract Only, Hardcopy, Microfiche

The prelaunch calibration of AXAF encompasses many aspects of the telescope. In principle, all that is needed is the complete point response function. This is, however, a function of energy, off-axis angle of the source, and operating mode of the facility. No single measurement would yield the entire result. Also, any calibration made prior to launch will be affected by changes in conditions after launch, such as the change from one g to zero g. The reflectivity of the mirror and perhaps even the detectors can change as well, for example by addition or removal of small amounts of material deposited on their surfaces. In this paper, we give a broad view of the issues in performing such a calibration, and discuss how they are being addressed in prelaunch preparation of AXAF. As our title indicates, we concentrate here on the total throughput of the observatory. This can be thought of as the integral of the point response function, i.e. the encircled energy, out ot the largest practical solid angle for an observation. Since there is no standard x-ray source in the sky whose flux is known to the -1% accuracy we are trying to achieve, we must do this calibration on the ground. we also must provide a means for monitoring any possible changes in this calibration from pre-launch until on-orbit operation can transfer the calibration to a celestial x-ray source whose emission is stable. In this paper, we analyze the elements of the absolute throughput calibration, which we call Effective Area. We review the requirements for calibrations of components or subsystems of the AXAF facility, including mirror, detectors, and gratings. We show how it is necessary to calibrate this ground-based detection system at standard man-made x-ray sources, such as electron storage rings. We present the status of all these calibrations, with indications of the measurements remaining to be done, even though the measurements on the AXAF flight optics and detectors will have been completed by the time this paper is presented. We evaluate progress toward the goal of making 1% measurements of the absolute x-ray flux from astrophysical sources, so that comparisons can be made with their emission at other wavelengths, in support of observations such as the Sunyaev-Zeldovitch effect, which can give absolute distance measurements independent of the traditional distance measuring techniques in astronomy.
Author
Telescopes; Calibrating; Distance Measuring Equipment; Reflectance

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PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion. For ionospheric plasmas see 46 Geophysics. For space plasmas see90 Astrophysics.

19990100609 Los Alamos National Lab., Theoretical Div., NM USA
Quantum Debye-Hueckel theory and the possible plasma phase transition
Baker, G.; Sep. 03, 1998; 4p; In English; 9th; International workshop on the physics of nonideal plasmas (PNP9)
Report No.(s): DE99-002553; LA-UR-98-3993; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

In this paper the author first sketches the calculation of the pressure of a neutral, ion-electron gas as an expansion in powers of the electron charge, e, by means of the Matsubara, finite-temperature, many-body, perturbation theory. He then goes on to derive the Debye-H(umlt u) term and other equations to support his contentions. His results support but do not prove the existence of a phase transition.
NTIS
Plasmas (Physics); Phase Transformations

19990102043 Department of Energy, Washington, DC USA
Fudge: a high-bandwidth fusion diagnostic of the NIF
Moran, M.; Jun. 02, 1998; 15p; In English; 12th; High-temperature plasma diagnostics
Report No.(s): DE98-058591; UCRL-JC-129972; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Diagnostics for the National Ignition Facility (NIF)/Inertial Confinement Fusion (ICF) program must include good characterization of the fusion source. Ideally, diagnostics would measure the spatially-resolved history of the fusion reaction rate and temperature. Existing diagnostics can satisfy this goal only partially. One class of new techniques that could play a major role in high-yield diagnostics is measurements based on fusion (gamma) rays. The Fusion Diagnostic Gamma Experiment (FUDGE) can be used to perform energy-resolved measurements of (D,T) fusion reaction rates. This diagnostic is based on the 16 7-MeV (gamma) rays that are produced by (D,T) fusion. The (gamma) rays are free of spectral dispersion and can be detected with a high

bandwidth Cherenkov detector. A simple magnetic monochromator selects signals from the 16 7-MeV (gamma) rays and reduces background signals from non-fusion (gamma) rays.

NTIS

Bandwidth; Plasma Diagnostics; Plasma Physics; Inertial Confinement Fusion

19990102044 Department of Energy, Washington, DC USA

Modeling of Thomson scattering spectra in high-z, laser produced plasmas

Rozmus, W.; Apr. 30, 1998; 20p; In English; 28th; Annual anomalous absorption conference

Report No.(s): DE98-058427; UCRL-JC-130646; CONF-9806107; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Theoretical calculations of a Thomson scattering cross section and dynamical form factors are presented for high-Z laser produced inhomogeneous plasmas. Relevance of these results to astrophysical plasmas is pointed out. Comparisons with recent experimental observations are discussed with emphasis on the effects of plasma inhomogeneity, ion-ion collisions and non-Maxwellian distribution functions.

NTIS

Thomson Scattering; Lasers; Scattering Cross Sections; Plasma Physics; Space Plasmas

19990102207 NASA Marshall Space Flight Center, Huntsville, AL USA

Preliminary Results from a Laboratory Study of the Charging Mechanisms of Particles in a Dusty Plasma

Venturini, Catherine C., Alabama Univ., USA; Spann, James F., NASA Marshall Space Flight Center, USA; Comfort, Richard H., NASA Marshall Space Flight Center, USA; 1998; In English; 7th; Physics of Dustry Plasmas, 5 Jun. 1998, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A laboratory study has been developed to experimentally study the interaction of micron sized particles with plasmas and electromagnetic radiation. The intent is to investigate under what conditions particles of various compositions and sizes become charged, or discharged, while exposed to an electron beam and ultraviolet radiation. Primary emphasis is on two charging mechanisms: secondary emission of electrons and the photoelectric effect. Preliminary results are presented.

Author

Laboratories; Research; Charging; Dust; Plasmas (Physics)

19990102215 NASA Marshall Space Flight Center, Huntsville, AL USA

Characteristics of Dynamic Activity in the Dayside Aurora

Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Parks, G. K., NASA Marshall Space Flight Center, USA; Chua, D., NASA Marshall Space Flight Center, USA; Elsen, R., NASA Marshall Space Flight Center, USA; Fillingim, M. O., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 32nd; Advances in Auroral Plasma Physics, 12-19 Jul. 1998, Nagoya, Japan; Sponsored by Committee on Space Research; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Long term global monitoring of the aurora by the Ultraviolet Imager (UVI) on the Polar spacecraft has enabled observation of auroral activity under various conditions of solar wind input. UVI is particularly suited to dayside imaging, especially in sunlit conditions during the northern hemisphere summer, owing to its solar blind narrow band filters. Several types of activity have been observed in the dayside aurora when observed on a global scale: enhancement of the auroral precipitation beginning at local noon and traveling along the flanks toward midnight observed in connection with solar wind shock fronts, regions of bright arcs traveling toward midnight that may be associated with boundary waves, and'break-up' like events in the high latitude midday region sometimes concurrent with a theta aurora. We will present several examples of dayside activity and discuss the possible mechanisms for these phenomena.

Author

Auroras; Polar Regions; Shock Fronts; Solar Wind; Daytime; Aeronomy

19990103056 Sandia National Labs., Albuquerque, NM USA

High-Density Plasma-Induced Etch Damage of GaN

Baca, A. G., Sandia National Labs., USA; Han, J., Sandia National Labs., USA; Lester, L. F., Sandia National Labs., USA; Pearton, S. J., Sandia National Labs., USA; Ren, F., Sandia National Labs., USA; Apr. 29, 1999; 10p; In English

Report No.(s): DE00-007208; SAND99-1080C; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

Anisotropic, smooth etching of the group-III nitrides has been reported at relatively high rates in high-density plasma etch systems. However, such etch results are often obtained under high de-bias and or high plasma flux conditions where plasma induced damage can be significant. Despite the fact that the group-III nitrides have higher bonding energies than more conventional III-V compounds, plasma-induced etch damage is still a concern. Attempts to minimize such damage by reducing the ion energy or increasing the chemical activity in the plasma often result in a loss of etch rate or anisotropy which significantly limits critical dimensions and reduces the utility of the process for device applications requiring vertical etch profiles. It is therefore necessary to develop plasma etch processes which couple anisotropy for critical dimension and sidewall profile control and high etch rates with low-damage for optimum device performance. In this study we report changes in sheet resistance and contact resistance for n- and p-type GaN samples exposed to an Ar inductively coupled plasma (ICP). In general, plasma-induced damage was more sensitive to ion bombardment energies as compared to plasma flux. In addition, p-GaN was typically more sensitive to plasma-induced damage as compared to n-GaN.
NTIS
Gallium Nitrides; Ion Irradiation; Plasmas (Physics); Etching; Damage

19990103590 NASA Goddard Space Flight Center, Greenbelt, MD USA
Reconnection in Three Dimensions
Analyzing the qualitative three-dimensional magnetic structure of a plasmoid, we were led to reconsider the concept of magnetic reconnection from a general point of view. The properties of relatively simple magnetic field models provide a strong preference for one of two definitions of magnetic reconnection that exist in the literature. Any concept of magnetic reconnection defined in terms of magnetic topology seen-is naturally restricted to cases where the magnetic field vanishes somewhere in the nonideal (diffusion) region. The main part of this paper is concerned with magnetic reconnection in nonvanishing magnetic fields (finite-B reconnection), which has attracted less attention in the past. We show that the electric field component parallel to the magnetic field plays a crucial physical role in finite-B reconnection, and we present two theorems involving the former. The first states a necessary and sufficient condition on the parallel electric field for global reconnection to occur. Here the term 'global" means the generic case where the breakdown of magnetic connection occurs for plasma elements that stay outside the nonideal region. The second theorem relates the change of magnetic helicity to the parallel electric field for cases where the electric field vanishes at large distances. That these results provide new insight into three-dimensional reconnection processes is illustrated in terms of the plasmoid configuration, which was our starting point.
Author
Electric Fields; Magnetic Field Reconnection; Magnetic Fields; Plasmas (Physics); Magnetic Field Configurations

19990103595 NASA Goddard Space Flight Center, Greenbelt, MD USA
Reconnection in Three Dimensions
Analyzing the qualitative three-dimensional magnetic structure of a plasmoid, we were led to reconsider the concept of magnetic reconnection from a general point of view. The properties of relatively simple magnetic field models provide a strong preference for one of two definitions of magnetic reconnection that exist in the literature. Any concept of magnetic reconnection defined in terms of magnetic topology seems naturally restricted to cases where the magnetic field vanishes somewhere in the nonideal (diffusion) region. The main part of this paper is concerned with magnetic reconnection in nonvanishing magnetic fields (finite-B reconnection), which has attracted less attention in the past. We show that the electric field component parallel to the magnetic field plays a crucial physical role in finite-B reconnection, and we present two theorems involving the former. The first states a necessary and sufficient condition on the parallel electric field for global reconnection to occur. Here the term "global' means the generic case where the breakdown of magnetic connection occurs for plasma elements that stay outside the nonideal region. The second theorem relates the change of magnetic helicity to the parallel electric field for cases where the electric field vanishes at large distances. That these results provide new insight into three-dimensional reconnection processes is illustrated in terms of the plasmoid configuration, which was our starting point.
Author
Magnetic Field Reconnection; Plasmas (Physics); Magnetic Field Configurations; Magnetic Fields; Magnetoplasmadynamics

19990104290 Southwest Research Inst., San Antonio, TX USA

Research on Orbital Plasma Electro-Dynamics (ROPE) *Final Report, 13 Dec. 1985 - 30 Sep. 1998*

September 1998; 6p; In English

Contract(s)/Grant(s): NAS8-36840; SwRI Proj. 15-8957

Report No.(s): NASA/CR-1999-209572; NAS 1.26:209572; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

This report spans activities covering approximately 13 years. This period includes both the TSS1 and 1R missions. As is well known the TSS1 mission was not successful due to the tether hanging in the reelout mechanism. This resulted in the approval of a reflight mission. TSS1-R. The reel mechanism did work on the reflight however the tether arced, burned through and flew away just as maximum length was being obtained. Thus only a few of the planned objectives were carried out. The good news is that all items delivered under this contract worked as planned. In addition the contract was completed on time and in scope with no overruns. Several publications have resulted even under these non-optimum conditions.

Author

Tethering; Reels; Performance Tests

19990104364 NASA Marshall Space Flight Center, Huntsville, AL USA

Guided Plasmaspheric Hiss Interactions with Superthermal Electrons, 1, Resonance Curves and Timescales

Liemohn, M. W., NASA Marshall Space Flight Center, USA; Khazanov, G. V., NASA Marshall Space Flight Center, USA; Kozyra, J. U., Michigan Univ., USA; 1999; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Under the proper conditions, guided plasmaspheric hiss is shown to be more efficient than Coulomb collisions at scattering electrons in the superthermal energy range of 50 to 500 eV. Broadband, whistler mode hiss becomes guided by plasma density gradients, intensifying the wave energy densities and focusing the wave normal angles. These waves are shown to interact through Cherenkov (Landau) resonance with electrons below 500 eV, and the presented equatorial plane timescales for pitch angle, energy, and mixed diffusion are shown to be faster than Coulomb collision timescales for typical values at the inner edge of the plasmapause and in detached plasma regions. In the latter case, energy diffusion timescales of less than 100 s for small pitch angle electrons between 250 and 500 eV indicate that these waves have the potential to dramatically change the distribution function.

Author

Distribution Functions; Electrons; Flux Density; Hiss; Pitch (Inclination); Plasmasphere; Whistlers; Electron Scattering; Plasmas (Physics)

19990104386 Princeton Plasma Physics Lab., Princeton, NJ USA

HINST: A 2-D Code for High-n TAE Stability

Cheng, C. Z., Princeton Plasma Physics Lab., USA; Gorelenkov, N. N., Princeton Plasma Physics Lab., USA; Tang, W. M., Princeton Plasma Physics Lab., USA; Apr. 01, 1998; 379p; In English

Report No.(s): DE00-003758; PPPL-3295; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

A high-n stability code, HINST, has been developed to study the stability of TAE (Toroidicity-induced Alfven Eigenmodes) in large tokamaks, such as ITER (International Thermonuclear Experimental Reactor), where the spectrum of unstable TAE modes is shifted toward medium- to high-n modes. The code solves the 2-D eigenmode problem by expanding the eigenfunction in terms of basis functions. Based on the Fourier-ballooning formalism the eigenmode problem is reduced to a system of coupled 1-D equations, which is solved numerically by using the finite element method and a SPARSE matrix solver. The numerical method allows including nonperturbatively non-ideal effects, such as: full ion FLR (Finite Larmor Radius), trapped-electron collisional damping, etc. The 2-D numerical results of TAE and Resonance TAE (RTAE) modes are compared with those from local ballooning calculations and global MHD NOVA code. The results show that for ITER-like plasma parameters, TAE and RTAE modes can be driven unstable by alpha particles for n = 10 - 20. The growth rate for the most unstable mode is within the range lambda divided by omega sub A approximately equal to 0.3 - 1.5%. The most unstable modes are localized near r = a approximately equal to 0.5 and have a broad radial mode envelope width.

NTIS

Magnetohydrodynamic Waves; Applications Programs (Computers); Tokamak Devices; Toroidal Plasmas; Magnetohydrodynamic Stability; Thermonuclear Reactions

19990104389 Princeton Plasma Physics Lab., Princeton, NJ USA

TAE Saturation of Alpha Particle Driven Instability in TFTR

Berk, H. L., Princeton Plasma Physics Lab., USA; Chen, Y., Princeton Plasma Physics Lab., USA; Gorelenkov, N. N., Princeton Plasma Physics Lab., USA; White, R. B., Princeton Plasma Physics Lab., USA; Sep. 15, 1998; 147p; In English

A nonlinear theory of kinetic instabilities near threshold (H.L. Berk, et al., Plasma Phys. Rep. 23, (1997) 842) is applied to calculate the saturation level of Toroidicity-induced Alfvn Eigenmodes (TAE) and be compared with the predictions of delta-f method calculations (Y. Chen, Ph.D. Thesis, Princeton University, 1998). Good agreement is observed between the predictions of both methods and the predicted saturation levels are comparable with experimentally measured amplitudes of the TAE oscillations in TFTR (D.J. Grove and D.M. Meade, Nucl. Fusion 25, (1985) 1167).
NTIS

Tokamak Devices; Applications Programs (Computers); Toroidal Plasmas; Fusion Reactors; Magnetohydrodynamic Waves

19990104596 Alaska Univ., Geophysical Inst., Fairbanks, AK USA

Kelvin Helmholtz Instability at the Equatorial Magnetotail Boundary: MHD Simulation and Comparison with Geotail Observations

Fairfield, Donald H., Alaska Univ., USA; Otto, A., Alaska Univ., USA; Aug. 19, 1999; 32p; In English

On March 24, 1995 the Geotail spacecraft observed large fluctuations of the magnetic field and plasma properties in the Low Latitude Boundary Layer (LLBL) about 15 R(sub E) tailward of the dusk meridian. Although the magnetospheric and the magnetosheath field were strongly northward, the B(sub z) component showed strong short duration fluctuations in which B(sub z) could even reach negative values. We have used two-dimensional magnetohydrodynamic simulations with magnetospheric and magnetosheath input parameters specifically chosen for this. Geotail event to identify the processes which cause the observed boundary properties. It is shown that these fluctuations can be explained by the Kelvin-Helmholtz instability if the k vector of the instability has a component along the magnetic field direction. The simulation results show many of the characteristic properties of the Geotail observations. In particular, the quasi-periodic strong fluctuations are well explained by satellite crossings through the Kelvin-Helmholtz vortices. It is illustrated how the interior structure of the Kelvin-Helmholtz vortices leads to the rapid fluctuations in the Geotail observations. Our results suggest an average Kelvin-Helmholtz wavelength of about 5 R(sub E) with a vortex size of close to 2 R(sub E) for an average repetition time of 2.5 minutes. The growth time for these waves implies a source region of about 10 to 16 R(sub E) upstream from the location of the Geotail spacecraft (i.e., near the dusk meridian). The results also indicate a considerable mass transport of magnetosheath material into the magnetosphere by magnetic reconnection in the Kelvin-Helmholtz vortices.
Author

Kelvin-Helmholtz Instability; Plasmas (Physics); Magnetic Fields; Magnetosheath; Geomagnetic Tail

19990105711 National Inst. for Fusion Science, Toki, Japan

Constructing Exactly Conservative Scheme in Non-Conservative Form

Tanaka, R., Tokyo Inst. of Tech., Japan; Nakamura, T., Tokyo Inst. of Tech., Japan; Yabe, T., Tokyo Inst. of Tech., Japan; August 1999; ISSN 0915-633X; 16p; In English

A non-conservative scheme that guarantees exact mass conservation is proposed. Although it is in a non-conservative form, the mass of each cell is employed as an additional variable that is advanced in a conservative form. Some numerical tests are carried out to demonstrate the mass conservation and the accurate calculation of the speed of a shock wave even without the viscosity term.
Author

Numerical Analysis; Hyperbolic Functions; Algorithms; Shock Waves

Includes superconductivity. For related information, see also 33 Electronics and Electrical Engineering and 36 Lasers and Masers.

19990099727 NASA Marshall Space Flight Center, Huntsville, AL USA

Molecular Static Third-Order Polarizabilities of Carbon-Cage Fullerene and Their Correlation with Three Geometric Properties: Symmetry, Aromaticity, and Size

Moore, C. E., NASA Marshall Space Flight Center, USA; Cardelino, B. H., NASA Marshall Space Flight Center, USA; Frazier, D. O., NASA Marshall Space Flight Center, USA; Niles, J., NASA Marshall Space Flight Center, USA; Wang, X.–Q., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The static third-order polarizabilities (gamma) of C60, C70, five isomers of C78 and two isomers of C84 were analyzed in terms of three properties, from a geometric point of view: symmetry, aromaticity and size. The polarizability values were based on the finite field approximation using a semiempirical Hamiltonian (AM1) and applied to molecular structures obtained from density functional theory calculations. Symmetry was characterized by the molecular group order. The selection of 6-member rings as aromatic was determined from an analysis of bond lengths. Maximum interatomic distance and surface area were the parameters considered with respect to size. Based on triple linear regression analysis, it was found that the static linear polarizability (alpha) and gamma in these molecules respond differently to geometrical properties: alpha depends almost exclusively on surface area while gamma is affected by a combination of number of aromatic rings, length and group order, in decreasing importance. In the case of alpha, valence electron contributions provide the same information as all-electron estimates. For gamma, the best correlation coefficients are obtained when all-electron estimates are used and when the dependent parameter is ln(gamma) instead of gamma.
Author
Carbon; Fullerenes; Polarization Characteristics; Symmetry; Size (Dimensions); Aromatic Compounds; Atomic Clusters

19990099730 NASA Marshall Space Flight Center, Huntsville, AL USA

Contactless Growth of ZnSe Single Crystals by Physical Vapor Transport

Su, Ching–Hua, NASA Marshall Space Flight Center, USA; George, M. A., Alabama Univ., USA; Feth, S., NASA Marshall Space Flight Center, USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Dec. 02, 1998; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy

ZnSe crystals were grown by self-seeded physical vapor transport (PVT) technique in the horizontal configuration. The source materials were heat treated by H2 reduction to remove the oxide followed by baking under dynamic vacuum to adjust the source composition toward that of congruent sublimation. Contactless growth of ZnSe single crystals have been performed consistently using three different source materials. The crystals grew away from the wall during the later stage of the growth with large (110) facets tend to align parallel to the gravity direction. The Scanning Electron Micrography (SEM) micrographs and the Atomic Force Microscope (AFM) images showed that large (110) terraces and steps dominate the as-grown facets. The measured residual gas pressures in the processed ampoules agree well among various source materials and the major components were CO and H2. No preferred growth direction was found. The one-dimensional diffusion model on the mass flux of a multi-species PVT system was employed to analyze the conditions for contactless growth. The calculated thermal profile for supersaturation is very close to the thermal profile measured inside the empty furnace bore in the region of contactless growth. The effects of convective flows in the vapor phase inside the ampoule on the growth processes are discussed.
Author
Single Crystals; Crystal Growth; Zinc Selenides; Crystallography; Crystallization; Polygonization

19990099731 NASA Marshall Space Flight Center, Huntsville, AL USA

Vapor Growth and Characterization of Cr-Doped ZnSe Crystals

Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Feth, Shari, NASA Marshall Space Flight Center, USA; Volz, M. P., NASA Marshall Space Flight Center, USA; Matyi, R., Wisconsin Univ., USA; George, M. A., Alabama Univ., USA; Burger, A., Fisk Univ., USA; Lehoczky, S. L., NASA Marshall Space Flight Center, USA; Dec. 02, 1998; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy

Cr-doped ZnSe single crystals were grown by self-seeded physical vapor transport technique under both vertical (stabilized) and horizontal configurations. The source materials were mixtures of ZnSe and CrSe. The growth temperatures were in the range of 1140 to 1150C and the furnace translation rates were 1.9 to 2.2 mm/day. The surface morphology of the as-grown crystals was examined by scanning electron microscopy (SEM) and atomic force microscopy (AFM). The different features on the as-grown surface of the vertically and horizontally grown crystals suggests that different growth mechanisms were involved for the two

growth configurations. The [Cr] doping levels were determined to be in the range of 1.8 to 8.3 x 10(exp 19)/cubic centimeter from optical absorption measurements. The crystalline quality of the grown crystals were examined by high resolution triple crystal X-ray diffraction (HRTXD) analysis.
Author

Crystals; Doped Crystals; Vapor Deposition; Crystal Growth; Zinc Selenides; Crystallography; Crystallization

19990100614 Los Alamos National Lab., NM USA
Polaronic signatures in phonon isotopic shifts
Mustre de Leon, J.; Coss, R.; Rubio–Ponce, A.; Bishop, A. R.; Trugman, S. A.; Dec. 31, 1998; 7p; In English; International conference on stripes and high T(sub c) superconductivity
Report No.(s): DE99-002545; LA-UR-98-3803; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

The effect of O16 by O18 isotopic substitution in the excitation spectrum of a model electron-phonon Hamiltonian, previously used to describe the dynamics of the O4-Cu1-O4 cluster in YBa2Cu3O7, is presented. This model includes electronic correlations and electron-phonon interactions, exhibiting the presence of polaron tunneling. The calculated isotopic shifts of phonon excitations differ from those found using harmonic or anharmonic potentials, and are consistent results of optical measurements of c-axis phonons. The isotopic substitution changes the dynamics of polaron tunneling and produces a change in the local structure.
NTIS

Polarons; Phonons; Spectral Signatures; Optical Measurement

19990100664 NASA Glenn Research Center, Cleveland, OH USA
Secondary Electron Emission Spectroscopy of Diamond Surfaces
Krainsky, Isay L., NASA Glenn Research Center, USA; Asnin, Vladimir M., NASA Glenn Research Center, USA; Petukhov, Andre G., South Dakota School of Mines and Technology, USA; October 1999; 26p; In English
Contract(s)/Grant(s): RTOP 632-50-5D
Report No.(s): NASA/TP-1999-208692; NAS 1.60:208692; E-11357; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report presents the results of the secondary electron emission spectroscopy study of hydrogenated diamond surfaces for single crystals and chemical vapor-deposited polycrystalline films. One-electron calculations of Auger spectra of diamond surfaces having various hydrogen coverages are presented, the major features of the experimental spectra are explained, and a theoretical model for Auger spectra of hydrogenated diamond surfaces is proposed. An energy shift and a change in the line shape of the carbon core-valence-valence (KVV) Auger spectra were observed for diamond surfaces after exposure to an electron beam or by annealing at temperatures higher than 950 C. This change is related to the redistribution of the valence-band local density of states caused by hydrogen desorption from the surface. A strong negative electron affinity (NEA) effect, which appeared as a large, narrow peak in the low-energy portion of the spectrum of the secondary electron energy distribution, was also observed on the diamond surfaces. A fine structure in this peak, which was found for the first time, reflected the energy structure of the bottom of the conduction band. Further, the breakup of the bulk excitons at the surface during secondary electron emission was attributed to one of the features of this structure. The study demonstrated that the NEA type depends on the extent of hydrogen coverage of the diamond surface, changing from the true type for the completely hydrogenated surface to the effective type for the partially hydrogenated surface.
Author

Auger Spectroscopy; Spectroscopic Analysis; Secondary Emission; Emission Spectra; Negative Electron Affinity; Energy Spectra; Spectral Energy Distribution; Fine Structure

19990100869 NASA Marshall Space Flight Center, Huntsville, AL USA
Fluorescence Studies of Protein Crystallization Interactions
Pusey, Marc L., NASA Marshall Space Flight Center, USA; Smith, Lori, Universities Space Research Association, USA; Forsythe, Elizabeth, Universities Space Research Association, USA; 1999; 1p; In English, 24 May 1999, Buffalo, NY, USA; Sponsored by American Crystallographic Association, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

We are investigating protein-protein interactions in under- and over-saturated crystallization solution conditions using fluorescence methods. The use of fluorescence requires fluorescent derivatives where the probe does not markedly affect the crystal packing. A number of chicken egg white lysozyme (CEWL) derivatives have been prepared, with the probes covalently attached to one of two different sites on the protein molecule; the side chain carboxyl of ASP 101, within the active site cleft, and the N-terminal amine. The ASP 101 derivatives crystallize while the N-terminal amine derivatives do not. However, the N-termi-

nal amine is part of the contact region between adjacent 43 helix chains, and blocking this site does would not interfere with formation of these structures in solution. Preliminary FRET data have been obtained at pH 4.6, 0.1M NaAC buffer, at 5 and 7% NaCl, 4 C, using the N-terminal bound pyrene acetic acid (PAA, Ex 340 nm, Em 376 nm) and ASP 101 bound Lucifer Yellow (LY, Ex 425 nm, Em 525 nm) probe combination. The corresponding Csat values are 0.471 and 0.362 mg/ml (approximately 3.3 and approximately 2.5 x 10 (exp 5) M respectively), and all experiments were carried out at approximately Csat or lower total protein concentration. The data at both salt concentrations show a consistent trend of decreasing fluorescence yield of the donor species (PAA) with increasing total protein concentration. This decrease is apparently more pronounced at 7% NaCl, consistent with the expected increased intermolecular interactions at higher salt concentrations (reflected in the lower solubility). The estimated average distance between protein molecules at 5 x 10 (exp 6) M is approximately 70 nm, well beyond the range where any FRET can be expected. The calculated RO, where 50% of the donor energy is transferred to the acceptor, for the PAA-CEWL * LY-CEWL system is 3.28 nm, based upon a PAA-CEWL quantum efficiency of 0.41.

Author

Fluorescence; Crystallization; Molecular Interactions; Protein Crystal Growth; Lysozyme

19990100873 NASA Marshall Space Flight Center, Huntsville, AL USA

Determining the Molecular Growth Mechanisms of Protein Crystal Faces by Atomic Force Microscopy

Nadarajah, Arunan, NASA Marshall Space Flight Center, USA; Li, Huayu, NASA Marshall Space Flight Center, USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 24 May 1999, Buffalo, NY, USA; Sponsored by American Crystallographic Association, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

A high resolution atomic force microscopy (AFM) study had shown that the molecular packing on the tetragonal lysozyme (110) face corresponded to only one of two possible packing arrangements, suggesting that growth layers on this face were of bimolecular height. Theoretical analyses of the packing also indicated that growth of this face should proceed by the addition of growth units of at least tetramer size corresponding to the 43 helices in the crystal. In this study an AFM linescan technique was devised to measure the dimensions of individual growth units on protein crystal faces as they were being incorporated into the lattice. Images of individual growth events on the (110) face of tetragonal lysozyme crystals were observed, shown by jump discontinuities in the growth step in the linescan images as shown in the figure. The growth unit dimension in the scanned direction was obtained from these images. A large number of scans in two directions on the (110) face were performed and the distribution of lysozyme growth unit sizes were obtained. A variety of unit sizes corresponding to 43 helices, were shown to participate in the growth process, with the 43 tetramer being the minimum observed size. This technique represents a new application for AFM allowing time resolved studies of molecular process to be carried out.

Author

Atomic Force Microscopy; Molecules; Protein Crystal Growth

19990100874 NASA Marshall Space Flight Center, Huntsville, AL USA

Energy Minimization of Molecular Features Observed on the (110) Face of Lysozyme Crystals

Perozzo, Mary A., NASA Marshall Space Flight Center; Konnert, John H., NASA Marshall Space Flight Center; Li, Huayu, NASA Marshall Space Flight Center; Nadarajah, Arunan, NASA Marshall Space Flight Center; Pusey, Marc, NASA Marshall Space Flight Center; 1999; 1p; In English, 24 May 1999, Buffalo, NY, USA; Sponsored by American Crystallographic Association, USA

Contract(s)/Grant(s): H-28423D; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Molecular dynamics and energy minimization have been carried out using the program XPLOR to check the plausibility of a model lysozyme crystal surface. The molecular features of the (110) face of lysozyme were observed using atomic force microscopy (AFM). A model of the crystal surface was constructed using the PDB file 193L, and was used to simulate an AFM image. Molecule translations, van der Waals radii, and assumed AFM tip shape were adjusted to maximize the correlation coefficient between the experimental and simulated images. The highest degree of 0 correlation (0.92) was obtained with the molecules displaced over 6 A from their positions within the bulk of the crystal. The quality of this starting model, the extent of energy minimization, and the correlation coefficient between the final model and the experimental data will be discussed.

Author

Molecular Dynamics; Lysozyme; Crystal Surfaces; Optimization

19990100876 NASA Marshall Space Flight Center, Huntsville, AL USA

Reciprocal Space Mapping of Macromolecular Crystals in the Home Laboratory

Snell, Edward H., NASA Marshall Space Flight Center, USA; Fewster, P. F., NASA Marshall Space Flight Center, USA; Andrew,

Norman, NASA Marshall Space Flight Center, USA; Boggon, T. J., NASA Marshall Space Flight Center, USA; Judge, Russell A., NASA Marshall Space Flight Center, USA; Pusey, Marc A., NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 23 May 1999, Buffalo, NY, USA; Sponsored by American Crystallographic Association, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Reciprocal space mapping techniques are used widely by the materials science community to provide physical information about their crystal samples. We have used similar methods at synchrotron sources to look at the quality of macromolecular crystals produced both on the ground and under microgravity conditions. The limited nature of synchrotron time has led us to explore the use of a high resolution materials research diffractometer to perform similar measurements in the home laboratory. Although the available intensity is much reduced due to the beam conditioning necessary for high reciprocal space resolution, lower resolution data can be collected in the same detail as the synchrotron source. Experiments can be optimized at home to make most benefit from the synchrotron time available. Preliminary results including information on the mosaicity and the internal strains from reciprocal space maps will be presented.
Author

Mapping; Molecules; Crystals

19990100883 NASA Marshall Space Flight Center, Huntsville, AL USA

Influence of Applied Thermal Gradients and a Static Magnetic Field on Bridgman-Grown GeSi Alloys

Volz, M. P., NASA Marshall Space Flight Center, USA; Szofran, F. R., NASA Marshall Space Flight Center, USA; Cobb, S. D., NASA Marshall Space Flight Center, USA; Ritter, T. M., North Carolina Univ., USA; 1999; 1p; In English; 44th, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering, USA; No Copyright; Avail: Issuing Activity, Hardcopy

The effect of applied axial and radial thermal gradients and an axial static magnetic field on the macrosegregation profiles of Bridgman-grown GeSi alloy crystals has been assessed. The axial thermal gradients were adjusted by changing the control setpoints of a seven-zone vertical Bridgman furnace. The radial thermal gradients were affected by growing samples in ampoules with different thermal conductivities, namely graphite, hot-pressed boron nitride (BN), and pyrolytic boron nitride (PBN). Those samples grown in a graphite ampoule exhibited radial profiles consistent with a highly concave interface and axial profiles indicative of complete mixing in the melt. The samples grown in BN and PBN ampoules had less radial variation. Axial macrosegregation profiles of these samples fell between the predictions for a completely mixed melt and one where solute transport is dominated by diffusion. All of the samples were grown on Ge seeds. This resulted in a period of free growth until the Si concentration in the solid was in equilibrium with the Si concentration in the liquid. The length of crystal grown during this period was inversely proportional to the applied axial thermal gradient. Several samples were grown in an axial 5 Tesla magnetic field. Measured macroscopic segregation profiles on these samples indicate that the magnetic field did not, in general, reduce the melt flow velocities to below the growth velocities.
Author

Crystals; Magnetostatic Fields; Temperature Gradients; Germanium Compounds; Silicon Compounds; Crystal Growth; Crystallography

19990102210 NASA Marshall Space Flight Center, Huntsville, AL USA

Volume Diffusion Growth Kinetics and Step Geometry in Crystal Growth

Mazuruk, Konstantin, NASA Marshall Space Flight Center, USA; Ramachandran, Narayanan, NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Aerospace Sciences, 11-16 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics

Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The role of step geometry in two-dimensional stationary volume diff4sion process used in crystal growth kinetics models is investigated. Three different interface shapes: a) a planar interface, b) an equidistant hemispherical bumps train tAx interface, and c) a train of right angled steps, are used in this comparative study. The ratio of the super-saturation to the diffusive flux at the step position is used as a control parameter. The value of this parameter can vary as much as 50% for different geometries. An approximate analytical formula is derived for the right angled steps geometry. In addition to the kinetic models, this formula can be utilized in macrostep growth models. Finally, numerical modeling of the diffusive and convective transport for equidistant steps is conducted. In particular, the role of fluid flow resulting from the advancement of steps and its contribution to the transport of species to the steps is investigated.
Author

Crystal Growth; Diffusion; Kinetics; Two Dimensional Models

19990102225 NASA Marshall Space Flight Center, Huntsville, AL USA
Characterization of Semi-Insulating CdTe Crystals Grown by Horizontal Seeded Physical Vapor Transport
Chattopadhyay, K., Fisk Univ., USA; Feth, S., Fisk Univ., USA; Chen, H., Fisk Univ., USA; Burger, A., Fisk Univ., USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity, Hardcopy

CdTe crystals were grown by horizontal seeded physical vapor transport technique in uncoated and boron nitride coated fused silica ampoules with the source materials near the congruent sublimation condition. The grown crystals were characterized by current-voltage measurements, low temperature photoluminescence spectroscopy, near IR transmission optical microscopy, spark source mass spectroscopy and chemical etching. The measured resistivities of the crystals were in the high-10(exp 8) ohm-cm range. Although the crystal grown in the boron nitride coating was contaminated with boron from the photoluminescence measurements, the coating yielded a single crystal with no inclusions or precipitates.
Author
Insulation; Insulators; Cadmium Tellurides; Crystal Growth; Single Crystals

19990102413 NASA Marshall Space Flight Center, Huntsville, AL USA
Numerical Simulation of THM Growth of CdTe in Presence of Rotating Magnetic Fields
Ghaddar, Chahid K., Cape Simulations, Inc., USA; Lee, Cheo K., Cape Simulations, Inc., USA; Motakef, Sharihar, Cape Simulations, Inc., USA; Gillies, Donald, NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The influence of rotating magnetic fields (RMF) on the flow pattern and compositional uniformity in the solution zone of a traveling heater method (THM) system for growth of CdTe is numerically investigated. The analysis is conducted at the 10(exp -6) and 10(exp -1) g(sub 0) as representative of space and ground processing conditions. It is shown that under microgravity conditions, application of RMF can be used to overwhelm residual buoyancy-induced convection and to control the uniformity of solution-zone composition at the growth front without appreciable modification of the growth interface shape. At high gravity levels, RMF is found not to be able to completely dominate buoyancy-induced convection. In this regime, for the range of field strengths studied, RMF is found to result in a) complex flow structures in the solution zone, b) enhancement of compositional non-uniformities at the growth front, and c) increased convexity of the growth interface. A scaling analysis of convection in the solution zone is used to generate a non-dimensional map delineating the RMF- and gravity-dominated flow regimes.
Author
Magnetic Effects; Magnetic Fields; Field Strength; Flow Distribution

19990102546 Universities Space Research Association, Huntsville, AL USA
Control of Meridional Flow by a Non-Uniform Rotational Magnetic Field
Mazuruk, Konstantin, Universities Space Research Association, USA; Ramachandran, Narayanan, Universities Space Research Association, USA; 1999; 1p; In English; Aerospace Sciences, 11-16 Jan. 1999, Reno, NV, USA; Sponsored by American Inst. of Aeronautics and Astronautics
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The diffusive mass transfer of species during crystal growth in vertical ampoules is significantly affected by fluid flow in the liquid mother phase (melt). For electrically conductive melts, an elegant way of remotely inducing and controlling this flow is by utilizing a uniform rotational magnetic field (RMF) in the transverse direction. It induces an azimuthal flow which tends to homogenize the thermal and solutal fields. The rotating field also reduces the diffusion boundary layer, stabilizes temperature fluctuations, and promotes better overall crystal growth. For moderate strengths of the applied magnetic field (2-20 m Tesla) with frequencies of up to 400 Hz, the induced secondary meridional flow becomes significant. It typically consists of one roll at the bottom of the liquid column and a second roll (vortex) at the top. The flow along the centerline (ampoule axis) is directed from the growing solid (interface) towards the liquid (melt). In case of convex interfaces (e.g. in floating zone crystal growth) such flow behavior is beneficial since it suppresses diffusion at the center. However, for concave interfaces (e.g. vertical Bridgman crystal growth) such a flow tends to exacerbate the situation in making the interface shape more concave. It would be beneficial to have some control of this meridional flow- for example, a single recirculating cell with controllable direction and flow magnitude will make this technique even more attractive for crystal growth. Such flow control is a possibility if a non-uniform PNE field is utilized for this purpose. Although this idea has been proposed earlier, it has not been conclusively demonstrated so far. In this work, we derive the governing equations for the fluid dynamics for such a system and obtain solutions for a few important cases. Results from parallel experimental measurements of fluid flow in a mercury column subjected to non-uniform RMF will also be presented.
Author
Fluid Flow; Flow Velocity; Magnetic Fields; Nonuniform Magnetic Fields; Crystal Growth; Meridional Flow

19990102611 Universities Space Research Association, Huntsville, AL USA
Use of Traveling Magnetic Fields to Control Melt Convection
Ramachandran, N., Universities Space Research Association, USA; Mazuruk, K., Universities Space Research Association, USA; 1999; 1p; In English; Optical Science, Engineering, and Instrumentation, 18 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

An axially traveling magnetic wave induces a meridional basic flow in a molten cylindrical zone. This flow can be beneficial for crystal growth applications. In particular, it can be used to effectively stir the melt in long cylindrical columns. Also, it can beneficially modify the thermal and species concentration fields in the melt and the interface shape of the growing crystal. The basic theory of such an application is developed and preliminary data from a mercury column experiment are also presented.
Author
Traveling Waves; Magnetic Fields; Meridional Flow; Zonal Flow (Meteorology)

19990102612 Universities Space Research Association, Huntsville, AL USA
Numerical Modeling of Crystal of ZnSe by Physical Vapor Transport - Towards a more Comprehensive Formulations
Ramachandran, N., Universities Space Research Association, USA; 1999; In English; 3rd; Solidification and Gravity, 26 Apr. 1999, Miskole, Hungary
Contract(s)/Grant(s): NCC8-66; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Crystal growth from the vapor phase has various advantages over melt growth. The main advantage is from a lower processing temperature which makes the process more amenable in instances where the melting temperature of the crystal is high. Other benefits stem from the inherent purification mechanism in the process due to differences in the vapor pressures of the native elements and impurities, and the enhanced interfacial morphological stability during the growth process. Further, the implementation of PVT growth in closed ampoules affords experimental simplicity with minimal needs for complex process control which makes it an ideal candidate for space investigations in systems where gravity tends to have undesirable effects on the growth process. Bulk growth of wide band gap II-VI semiconductors by physical vapor transport has been developed and refined over the past several years at NASA MSFC. Results from a modeling study of PVT crystal growth of ZnSe are reported in this paper. The PVT process is numerically investigated using both two-dimensional and fully three-dimensional formulation of the governing equations and associated boundary conditions. Both the incompressible Boussinesq approximation and the compressible model are tested to determine the influence of gravity on the process and to discern the differences between the two approaches. The influence of a residual gas is included in the models. The results show that both the incompressible and compressible approximations provide comparable results and the presence of a residual gas tends to measurably reduce the mass flux in the system. Detailed flow, thermal and concentration profiles will be provided in the final manuscript along with computed heat and mass transfer rates. Comparisons with the 1-D model will also be provided. The effect of gravity on the process from numerical computations shows subtle effects although experimental evidence from vertically and horizontally grown samples show dramatic evidence of gravitational effects. The shortcomings of the problem formulation will be discussed and a framework will be provided leading up towards a more comprehensive model of PVT systems.
Author
Crystal Growth; Crystals; Crystallography; Vapor Phases; Melts (Crystal Growth)

19990102898 Los Alamos National Lab., Theoretical Div., NM USA
Introduction to lattice QCD
Gupta, R.; Dec. 31, 1998; 151p; In English
Report No.(s): DE99-002071; LA-UR-98-3174; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

The goal of the lectures on lattice QCD (LQCD) is to provide an overview of both the technical issues and the progress made so far in obtaining phenomenologically useful numbers. The lectures consist of three parts. The author's charter is to provide an introduction to LQCD and outline the scope of LQCD calculations. In the second set of lectures, Guido Martinelli will discuss the progress they have made so far in obtaining results, and their impact on Standard Model phenomenology. Finally, Martin Luescher will discuss the topical subjects of chiral symmetry, improved formulation of lattice QCD, and the impact these improvements will have on the quality of results expected from the next generation of simulations.
NTIS
Quantum Chromodynamics; Lattices (Mathematics)

NASA Marshall Space Flight Center, Huntsville, AL USA
Crystal Growth of ZnSe by Physical Vapor Transport: A Modeling Study
Ramachandran, Narayanan, Universities Space Research Association, USA; Su, Ching–Hua, NASA Marshall Space Flight Center, USA; [1998]; In English; ICCG Conference, 26-31 Jul. 1998, Jerusalem, Israel; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Crystal growth from the vapor phase has various advantages over melt growth. The main advantage is from a lower processing temperature which makes the process more amenable in instances where the melting temperature of the crystal is high. Other benefits stem from the inherent purification mechanism in the process due to differences in the vapor pressures of the native elements and impurities, and the enhanced interfacial morphological stability during the growth process. Further, the implementation of Physical Vapor Transport (PVT) growth in closed ampoules affords experimental simplicity with minimal needs for complex process control which makes it an ideal candidate for space investigations in systems where gravity tends to have undesirable effects on the growth process. Bulk growth of wide band gap II-VI semiconductors by physical vapor transport has been developed and refined over the past several years at NASA MSFC. Results from a modeling study of PVT crystal growth of ZnSe arc reported in this paper. The PVI process is numerically investigated using both two-dimensional and fully three-dimensional formulation of the governing equations and associated boundary conditions. Both the incompressible Boussinesq approximation and the compressible model are tested to determine the influence of gravity on the process and to discern the differences between the two approaches. The influence of a residual gas is included in the models. The preliminary results show that both the incompressible and compressible approximations provide comparable results and the presence of a residual gas tends to measurably reduce the mass flux in the system. Detailed flow, thermal and concentration profiles will be provided in the final manuscript along with computed heat and mass transfer rates. Comparisons with the 1-D model will also be provided.
Author
Boussinesq Approximation; Crystal Growth; Crystals; Gravitational Effects; Morphology; Vapor Phases; Models

Naval Research Lab., Washington, DC USA
Measurement of the Dielectric Strength of Quartz Crystalline Material
Lohrmann, Dieter R.; Wu, David C.; Jul. 14, 1999; 8p; In English
Report No.(s): AD-A365869; NRL/FR/5740--99-9919; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The dielectric strength of a sample of a 0.5 mm thick quartz wafer was measured to be 1.9 MV/cm.
DTIC
Dielectric Properties; Crystallinity

National Renewable Energy Lab., Golden, CO USA
Silicon Ingot Lifetime Tester for Large Crystals
Matthaus, A., National Renewable Energy Lab., USA; Mihalik, G. B., National Renewable Energy Lab., USA; May 02, 1999; 10p; In English, 17-22 Oct. 1999, Honolulu, HI, UK; Sponsored by Department of Energy, USA
Report No.(s): DE00-006942; NREL/CP-590-26499; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

A lifetime-measurement instrument has been developed to characterize large silicon ingots prior to wafering and polishing. It uses the direct-current photoconductance decay method and localized probing and illumination to achieve the necessary sensitivity on low-resistivity, large samples. A 940-nm, 60-Wp, pulsed-laser diode beam lights the ascropped silicon surface between two ohmic-contact probes. A user-friendly graphical interface supports data acquisition, lifetime calculation, and data storage. Pneumatic systems position the ingot and probes. Three-dimensional, finite-element analysis indicates that the detection depth of this technique is much better than the microwave or radio-frequency techniques. It also shows that the as-cropped surface finish is adequate for measuring bulk lifetimes on the order of 50 ms or less-a typical range for Czochralski ingots used in photovoltaic module production. Measurement repeatability and clear distinction among different grades of feedstock materials have been demonstrated.
NTIS
Measuring Instruments; Silicon; Crystals; Czochralski Method; Finite Element Method; Ingots; Semiconductor Lasers

Rutherford Appleton Lab., ISIS Facility, Chilton, UK
NMR and Neutron Scattering Experiments: Indications for Magnetic Inhomogeneities in High-T(c) Cuprates
Morr, D. K.; Schmalian, J.; Pines, D.; Jul. 29, 1999; ISSN 1358-6254; 16p; In English
Report No.(s): PB99-168767; RAL-TR-1999-053; Copyright; Avail: National Technical Information Service (NTIS), Microfiche, Hardcopy

In this communication we consider the doping dependence of the strong antiferromagnetic fluctuations in the cuprate super-conductors. We will show that nuclear magnetic resonance (NMR) and inelastic neutron scattering (INS) experiments can be described within a single theoretical scenario. We investigate the effect of an incommensurate magnetic response, as recently observed in INS experiments on several YBa2Cu3O6+x compounds, on the spin-lattice and spin-echo relaxation rates measured in NMR experiments. We conclude that a consistent theoretical description of INS and NMR can be reached if one assumes spatially inhomogeneous but locally commensurate spin correlations. We discuss a simple scenario of magnetic inhomogeneties which includes the main physical ingredients required to be consistent with experiments.

NTIS

Nuclear Magnetic Resonance; Neutron Scattering; Superconductors (Materials); Inelastic Scattering; Cuprates; Spin-Lattice Relaxation

19990103146 NASA Marshall Space Flight Center, Huntsville, AL USA

Determining the Molecular Growth Mechanisms of Protein Crystal faces by Atomic Force Microscopy

Li, Huayu, Toledo Univ., USA; Nadarajah, Arunan, Toledo Univ., USA; Pusey, Marc L., NASA Marshall Space Flight Center, USA; June 1998; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A high resolution atomic force microscopy (AFM) study had shown that the molecular packing on the tetragonal lysozyme (110) face corresponded to only one of two possible packing arrangements, suggesting that growth layers on this face were of bimolecular height (Li et al., 1998). Theoretical analyses of the packing had also indicated that growth of this face should proceed by the addition of growth units of at least tetramer size corresponding to the 43 helices in the crystal. In this study an AFM linescan technique was devised to measure the dimensions of individual growth units on protein crystal faces. The growth process of tetragonal lysozyme crystals was slowed down by employing very low supersaturations. As a result images of individual growth events on the (110) face were observed, shown by jump discontinuities in the growth step in the linescan images. The growth unit dimension in the scanned direction was obtained by suitably averaging these images. A large number of scans in two directions on the (110) face were performed and the distribution of lysozyme aggregate sizes were obtained. A variety of growth units, all of which were 43 helical lysozyme aggregates, were shown to participate in the growth process with a 43 tetramer being the minimum observed size. This technique represents a new application for AFM allowing time resolved studies of molecular process to be carried out.

Author

Protein Crystal Growth; Atomic Force Microscopy; Molecular Structure

19990103166 NASA Marshall Space Flight Center, Huntsville, AL USA

In-Situ Optical Determination of Thermomechanical Properties of ZnSe and ZnTe Crystals

Burger, A., Fisk Univ., USA; Ndap, J.–O., Fisk Univ., USA; Chattopadhyay, K., Fisk Univ., USA; Ma, X., Fisk Univ., USA; Silberman, E., Fisk Univ., USA; Feth, S., NASA Marshall Space Flight Center, USA; Palosz, W., NASA Marshall Space Flight Center, USA; Su, C.–H., NASA Marshall Space Flight Center, USA; 1999; 1p; In English; 44th, 18-23 Jul. 1999, Denver, CO, USA; Sponsored by International Society for Optical Engineering; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

At temperatures above 1/2 T(sub m), the generation and movement of dislocations may result due to the load created by the weight of the crystal itself The deformation may be expected to increase the line defect density and may result in generation of low angle grain boundaries, especially in the regions of the crystal attached to the ampule. It has often been suspected that elimination of this effect in space can improve crystallinity of crystals grown under microgravity conditions, however, a direct experimental proof of such relation is still missing. In this work we have designed and built a system of in-situ optical detection and measurement of the mechanical deformations of a crystal wafer under its own weight, and studied the deformation effects as a function of temperature. The results of the measurements for ZnSe and ZnTe crystal wafers will be presented.

Author

Mechanical Properties; Optical Measurement; Zinc Tellurides; Tellurium Compounds; Defects; Deformation

19990103949 NASA Marshall Space Flight Center, Huntsville, AL USA

Photoluminescence Studies of ZnSe Starting Materials and Vapor Grown Bulk Crystals

Su, Ching–Hua, NASA Marshall Space Flight Center, USA; Feth, Shari, NASA Marshall Space Flight Center, USA; Wang, Ling Jun, Tennessee Univ., USA; Lehoczky, Sandor L., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Low-temperature photoluminescence (PL) spectra and glow discharge mass spectroscopy (GDMS) were measured on ZnSe starting materials provided by various vendors and on bulk crystals grown from these starting materials by physical vapor transport (PVT) to study the effects of purification and contamination during crystal growth process. The purification effect of pre-growth heat treatments and the PVT process is evidenced from the GDMS results which showed orders of magnitude reduction in the Li and Na concentration and a factor of 3 reduction in the 0 content after growth. The PL spectra showed that the strong emissions associated with Li (or Na) in one of the starting materials disappeared after growth. to evaluate the contamination of the crystal during the high temperature growth process three growth runs were processed using similar growth parameters but with different furnace environments. The GDMS results showed orders of magnitude increase in the Al and Si contents after growth. The PL spectra suggest that the Al contamination was originated from the fused silica ampoule and the Inconel cartridge might have been the cause for the broad Cu green and Cu red bands observed in one of the grown crystal.
Author
Photoluminescence; Zinc Selenides; Vapors; Crystal Growth; Research

19990103971 National Inst. of Standards and Technology, Electronics and Electrical Engineering Lab., Gaithersburg, MD USA
NIST List of Publications LP 103, March 1999. National Semiconductor Metrology Program
Settle–Raskin, A., National Inst. of Standards and Technology, USA; Mar. 1999; 150p; In English
Report No.(s): PB99-155541; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

This List of Publications includes all papers relevant to semiconductor technology published by NIST staff, including work of the National Semiconductor Metrology Program, the Semiconductor Electronics Division, and other parts of NIST having independent interests in semiconductor metrology. Bibliographic information is provided for publications from 1990 through 1998. Within each year, citations of published papers are listed alphabetically by first author. Indexes are provided by topic area and by author. Publications are referred to in the Topic and Author Indexes according to publication year and citation number (e.g. 98-3 refers to the third publication in the year 1998). A listing of software available from the Semiconductor Electronics Division is given on page 87 along with contacts for additional information and for copies of the computer programs. Publications covering the period from 1962 through 1989 prior to 1990 are found in a separate list, NIST List of Publications LP 72, Semiconductor Measurement Technology, which contains bibliographies and a listing of software, videotapes, and progress reports.
NTIS
Bibliographies; Metrology; Research Projects; Semiconductors (Materials); Computer Programs

19990104349 SensArray Corp., Burlington, MA USA
Doped PMN-PT Single Crystals *Monthly Report, 18 Jun. 1999 - 17 Jul. 1999*
Gabbe, D. R.; Cabanas–Holmen, M. F.; Jul. 17, 1999; 6p; In English
Contract(s)/Grant(s): N66604-99-C-0226
Report No.(s): AD-A366329; M-0109-07; No Copyright; Avail: CASI; A01, Microfiche; A02, Hardcopy

The subject of this work is optimization and scale up of top-seeded solution growth (TSSG) of the title single crystals leading to the commercialization of the growth of test-quality piezoelectric and electrostrictive materials for Naval as well as civilian applications. Test-quality, transparent inclusion-free specimens have been obtained from two crystals. Two growth runs are in progress. A second high precision Yokogawa Model UP-550 temperature controller was installed. Two supporting software applications were placed into operation, LL-200 for parameter setup and SpecView Plus for data acquisition and reporting. The effects of temperature lowering rate, crystal rotation rate, melt composition, thermal gradient, and platinum seed configuration, on crystal quality continue to be examined. Axial and radial thin sections have been cut from a number of crystals allowing visual inspection of inclusions as well as selection of test-quality specimens. Structures suggesting interface instability caused by too high a growth rate have been observed. Other inclusions appear to consist of regions of trapped liquid phase.
DTIC
Single Crystals; Doped Crystals; Crystal Growth

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THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics. For related information see also 25 Inorganic and Physical Chemistry and 34 Fluid Mechanics and Heat Transfer.

19990100615 Los Alamos National Lab., NM USA
Non-Hermitian quantum mechanics and localization in physical systems
Hatano, N.; Dec. 31, 1998; 4p; In English
Report No.(s): DE99-002544; LA-UR-98-3795; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Recent studies on a delocalization phenomenon of a non-Hermitian random system is reviewed. The complex spectrum of the system indicates delocalization transition of its eigenfunctions. It is emphasized that the delocalization is related to various physical phenomena such as flux-line pinning in superconductors and population biology of bacteria colony.
NTIS
Eigenvectors; Hamiltonian Functions; Quantum Mechanics

19990102417 NASA Goddard Space Flight Center, Greenbelt, MD USA
S-Wave Dispersion Relations: Exact Left Hand E-Plane Discontinuity from the Born Series
Bessis, D., Clark-Atlanta Univ., USA; Temkin, A., NASA Goddard Space Flight Center, USA; Mar. 29, 1999; 1p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

We show, for a superposition of Yukawa potentials, that the left hand cut discontinuity in the complex E plane of the (S-wave) scattering amplitude is given exactly, in an interval depending on n, by the discontinuity of the Born series stopped at order n. This also establishes an inverse and unexpected correspondence of the Born series at positive high energies and negative low energies. We can thus construct a viable dispersion relation (DR) for the partial (S-) wave amplitude. The high numerical precision achievable by the DR is demonstrated for the exponential potential at zero scattering energy. We also briefly discuss the extension of our results to Field Theory.
Author
Discontinuity; S Waves; Scattering; Wave Dispersion; Yukawa Potential

80
SOCIAL SCIENCES (GENERAL)

Includes educational matters.

19990102968 University Coll., Defence Engineering Group, London, UK
Educating Systems Engineers
Hambleton, K. G., University Coll., UK; Kirkpatrick, D. L. I., University Coll., UK; The Systems Engineering Framework: Managing and Integrating Complex Projects: Proceedings; 1999, pp. 4.1 - 4.4; In English; See also 19990102965; Copyright; Avail: Issuing Activity, Hardcopy

The new discipline of systems engineering is increasingly being exploited to manage large and complex projects. This paper discusses the nature of systems engineering, considers the application of systems engineering in equipment procurement, and reviews the opportunities for UK education in systems engineering.
Author
Systems Engineering; Education; England

19990104343 Norfolk State Univ., Ethelyn R. Strong School of Social Work, VA USA
The Science and Math for Everyone Project *Final Report, 1 Jun. 1997 - 31 Aug. 1999*
Newsome, Moses, Jr., Norfolk State Univ., USA; Paik, Hannah S., Norfolk State Univ., USA; 1999; 134p; In English
Contract(s)/Grant(s): NAG1-1937
Report No.(s): NLPN-97-415; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This is the final report of the Science and Math for Everyone Project, a special grant that was received by Norfolk State University for two years (from June 1997 to August 1999) from NASA Langley Research Center's Office of Education. The Science and Math for Everyone Project is a quasi-experimental research/education intervention strategy developed to assist disabled, economically disadvantaged, female or ethnic minority students in public school systems whose needs have been traditionally underserved and whose potential have been universally underdeveloped in the science and math areas. This project specifically intended

to assist these students to succeed in the subjects of science and math in local schools with six operationalized input and output goals. During the first year (1997-98 school year), 31 selected seventh graders from two middle schools in the Norfolk Public Schools (Lake Taylor and Northside) were served by four education undergraduate and four social work undergraduate interns. During the second year (1998-99 school year), 32 from seventh grade and 21 from eighth grade at Lake Taylor were served by the same number of interns. Education interventions consisted of (1) after-school academic activities three days a week, (2) social skills activities, and (3) several field trips with hands-on experience. Family interventions were implemented by four graduate social work interns in order to help parents of subjects better understand and get more involved in student learning activities. In addition, two formal training workshops were provided to a total of 55 teachers and other personnel to help them understand cultural diversity better and deal with the minority student population more effectively in the instructional environment.
Derived from text
Students; Education; Mathematics; Science; Research Projects

81
ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

19990101869 GPS Solutions, Inc., Carson City, NV USA
Effectiveness of Loan Guarantees versus Tax Incentives for Space Launch Ventures
Scottoline, S., GPS Solutions, Inc., USA; Coleman, R., GPS Solutions, Inc., USA; [1999]; 19p; In English; Space Technology, 28-30 Sep. 1999, Albuquerque, NM, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Over the course of the past few years, several new and innovative fully or partiailly reusable launch vehicle designs have been initiated with the objective of reducing the cost of space transportation. These new designs are in various stages hardware development for technology and system demonstrators. The larger vehicles include the Lockheed Martin X-33 technology demonstrator for VentureStar and the Space Access launcher. The smaller launcher ventures include Kelly Space and Technology and Rotary Rocket Company. A common denominator between the new large and small commercial launch systems is the ability to obtain project financing and at an affordable cost. Both are having or will have great difficulty in obtaining financing in the capital markets because of the dollar amounts and the risk involved. The large established companies are pursuing multi-billion dollar developments which are a major challenge to finance because of the size and risk of the projects. The smaller start-up companies require less capital for their smaller systems, however, their lack of corporate financial muscle and launch vehicle track record results in a major challenge to obtain financing also because of high risk. On Wall Street, new launch system financing is a question of market, technical, organizational, legal/regulatory and financial risk. The current limit of acceptable financial risk for Space businesses on Wall Street are the telecommunications and broadcast satellite projects, of which many in number are projected for the future. Tbc recent problems with Iridium market and financial performance are casting a long shadow over new satellite project financing, making it increasingly difficult for the new satellite projects to obtain needed financing.
Author (revised)
Cost Reduction; Finance; Market Research; Reusable Launch Vehicles; Spacecraft Launching

19990102965 Royal Aeronautical Society, London, UK
The Systems Engineering Framework: Managing and Integrating Complex Projects: Proceedings
1999; 58p; In English; The Systems Engineering Framework: Managing and Integrating Complex Projects, 8 Sep. 1999, London, UK; See also 19990102966 through 19990102969; ISBN 1-85768-141-X; Copyright; Avail: Issuing Activity, Hardcopy

Contents include the following: The system engineering process model. Integrated project teams. Educating systems engineering. and Adding value by integrating systems engineering and project management.
CASI
Conferences; Engineering Management

19990102967 Ministry of Defence, Defence Procurement Agency, Abbey Wood, UK
Integrated Project Teams
Little, Rob, Ministry of Defence, UK; The Systems Engineering Framework: Managing and Integrating Complex Projects: Proceedings; 1999, pp. 3.1 - 3.7; In English; See also 19990102965; Copyright; Avail: Issuing Activity, Hardcopy

The Strategic Defence Review has resulted in a major change programme within the Ministry of Defence. A sub-set of the change programme has been given the title SMART Procurement which introduces fundamental now process and organization

concepts which will affect all aspects of the ways In which defence projects are managed. The paper presents a short overview of these changes which Include a new procurement cycle, the adoption of a systems engineering process for requirements capture and management, and the introduction of Integrated project teams. The Impact of these change Initiatives on the Future Offensive Air System (FOAS) project Is described to Illustrate how future procurements will be "faster, cheaper, befter".

Author

Systems Engineering; Procurement

19990102969 Intellectual Capital Services Ltd., London, UK

Adding Value by Integrating Systems Engineering and Project Management

MPherson, Philip K., Intellectual Capital Services Ltd., UK; The Systems Engineering Framework: Managing and Integrating Complex Projects: Proceedings; 1999, pp. 5.1 - 5.16; In English; See also 19990102965; Copyright; Avail: Issuing Activity, Hard-copy

The case for thinking of systems engineering (SE) and project management (PM) as part and parcel of each other is argued on the grounds that procedurally they are inextricably interlinked, that their combined costs are the entry costs to a systems life-cycle, that the combined purpose of project and system is to add through-life value to the stakeholders. Cost is only one dimension of value, and all stakeholders have a say in what is cost-effective and valuable with respect to their points of view. A formal frame-work for integrated SE and PM is declared, and the issue of 'faster, cheaper, better' is raised: the attainment of all three attributes simultaneously is problematical, particularly when seen from different stakeholder perspectives. An integrated approach to trade-offs is offered based on the recognition that the validation and verification stages of system development are essentially measuring the proposed system for the value achieved with respect to user and system requirements. The approach is based on the foundations of axiomatic measurement and leads to the early definition of the necessary and sufficient user/systen/project requirements in a value space that encompasses all the stakeholders and their principal objectives. In turn this leads to the definition of a design space in which any change is admissible provided that the related change in system life-cycle worth is positive. The addition of value to cost-effectiveness in an integrated manner provides designers and decision-makers with more room for maneuver as they search for solution that satisfies technical, operational, economic, stakeholder and political criteria.

Author

Systems Engineering; Engineering Management; Project Management

19990102996 Patent and Trademark Office, Washington, DC USA

Industrial Patent Activity in the USA. Part 1. Time Series Profiles by Company and Country of Origin, 1974-1998

Sep. 1999; 572p; In English

Report No.(s): PB99-160897; No Copyright; Avail: CASI; A24, Hardcopy; A04, Microfiche

This report is a ranked listing of the 36 countries and more than 9,200 organizations which received the most patents during the period 1974 to 1998. For each country and organization, yearly patent counts are shown.

NTIS

Organizations; Patents; Inventions

19990102997 Patent and Trademark Office, Washington, DC USA

Industrial Patent Activity in the USA. Part 2. Alphabetical Listing by Company, 1974-1998

Sep. 1999; 396p; In English

Report No.(s): PB99-160905; No Copyright; Avail: CASI; A17, Hardcopy; A04, Microfiche

This report is an alphabetical listing of U.S. and foreign organizations which received 5 or more U.S. patents during the period 1974 to 1998. It includes some 26,000 corporations, government agencies, and universities. For each organization, the report shows the total patent count for the 25-year range and annual counts for each of the last 14 years.

NTIS

Organizations; Patents; Inventions

19990103033 TRW, Inc., San Diego, CA USA

Military Products from Commercial Lines Volume IA - Business Practices Manual *Final Report, 4 May 1994 - 4 Sep. 1998*

Feb. 1999; 214p; In English

Contract(s)/Grant(s): F33615-93-C-4335; AF Proj. 3095

Report No.(s): AD-A365905; AFRL-ML-WP-TR-1999-4112; No Copyright; Avail: CASI; A03, Microfiche; A10, Hardcopy

This Business Practices (BP) Manual is the product of the Industrial Base Pilot (IBP) Military Products from Commercial Lines (MPCL) contract awarded by the Air Force Research Laboratory's Manufacturing Technology Division at Wright- Patter-

son Ohio. The objective of the manual is to enable the development and manufacture of military products using commercial sources. The Business Practices Manual was developed by an Integrated Support Team (IST) comprised of representatives from defense customers and avionics contractors as well as from commercial suppliers and from national associations. Although developed specifically for electronics, these requirements also useable for any airframes and engines. This document should be used in conjunction with the IBP Model contract to provide a new paradigm for government procurement of military products.
DTIC

Government Procurement; Management Planning

19990103096 NASA Goddard Space Flight Center, Greenbelt, MD USA
Continuous Risk Management: A NASA Program Initiative
Hammer, Theodore F., NASA Goddard Space Flight Center, USA; Rosenberg, Linda, Unisys Corp., USA; May 1999; In English; 11th, May 1999, Salt Lake, UT, USA
Contract(s)/Grant(s): NAS5-32910; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

   NPG 7120.5A, "NASA Program and Project Management Processes and Requirements" enacted in April, 1998, requires that "The program or project manager shall apply risk management principles..." The Software Assurance Technology Center (SATC) at NASA GSFC has been tasked with the responsibility for developing and teaching a systems level course for risk management that provides information on how to comply with this edict. The course was developed in conjunction with the Software Engineering Institute at Carnegie Mellon University, then tailored to the NASA systems community. This presentation will briefly discuss the six functions for risk management: (1) Identify the risks in a specific format; (2) Analyze the risk probability, impact/severity, and timeframe; (3) Plan the approach; (4) Track the risk through data compilation and analysis; (5) Control and monitor the risk; (6) Communicate and document the process and decisions.
Author

Probability Theory; Risk; Software Engineering; Project Management; Software Reliability

19990103117 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Managing for Results: Opportunities for Continued Improvements in Agencies' Performance Plans
Jul. 1999; 128p
Report No.(s): PB99-168080; GAO/GGD/AIMD-99-215; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

   The Government Performance and Results Act of 1993 (Results Act) seeks to shift the focus of government performance and accountability away from a preoccupation with activities to a focus on the results or outcomes of those activities. The Results Act requires agencies to produce annual performance plans to clearly inform Congress and the public of the annual performance goals for agencies' major programs and activities, the measures that will be used to gauge performance, the strategies and resources required to achieve the performance goals, and the procedures that will be used to verify and validate performance information.
NTIS

Governments; Evaluation; Performance Prediction; Reliability; Management Planning

82
DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography. For computer documentation see 61 Computer Programming and Software.

19990100594 Department of Energy, Energy Information Administration, Washington, DC USA
Energy information directory 1998
Nov. 30, 1998; 111p; In English
Report No.(s): DE99-000116; DOE/EIA-0205(98); No Copyright; Avail: Department of Energy Information Bridge, Hardcopy

   The National Energy Information Center (NEIC), as part of its mission, provides energy information and referral assistance to Federal, State, and local governments, the academic community, business and industrial organizations, and the general public. The two principal functions related to this task are: (1) operating a general access telephone line, and (2) responding to energy-related correspondence addressed to the Energy Information Administration (EIA). The Energy Information Directory was developed to assist the NEIC staff, as well as other Department of Energy (DOE) staff, in directing inquiries to the proper offices within

DOE, other Federal agencies, or energy-related trade associations. The Directory lists most Government offices and trade associations that are involved in energy matters.
NTIS
Directories; Energy Conservation; Energy Consumption; Energy Technology

19990102929 Physics and Electronics Lab. TNO, The Hague, Netherlands
Survey of Information Warfare, Information Operations and Information Assurance *Final Report Verkenning naar Information Warfare, Information Operations en Information Assurance*
Luiijf, H. A. M., Physics and Electronics Lab. TNO, Netherlands; July 1999; 100p; In Dutch; Original contains color illustrations
Contract(s)/Grant(s): A99/D/603; TNO Proj. 28853
Report No.(s): TD99-0228; FEL-99-A142; Copyright; Avail: Issuing Activity, Hardcopy
     Research survey on the phenomena Information Warfare, Information Operations (Info Ops) and Information Assurance. History, development, definitions and developments in various countries around the globe. Appendix: list of abbreviations of terms in these fields.
Author
Research; Information Management; Operations Research; Surveys

19990103047 Los Alamos National Lab., NM USA
Knowledge discovery: Extracting usable information from large amounts of data
Whiteson, R.; Dec. 31, 1998; 8p; In English; INMM/ESARDA workshop on science and modern technology for safeguards
Report No.(s): DE99-002571; LA-UR-98-4077; No Copyright; Avail: Department of Energy Information Bridge, Hardcopy
     The threat of nuclear weapons proliferation is a problem of world wide concern. Safeguards are the key to nuclear nonproliferation and data is the key to safeguards. The safeguards community has access to a huge and steadily growing volume of data. The advantages of this data rich environment are obvious, there is a great deal of information which can be utilized. The challenge is to effectively apply proven and developing technologies to find and extract usable information from that data. That information must then be assessed and evaluated to produce the knowledge needed for crucial decision making. Efficient and effective analysis of safeguards data will depend on utilizing technologies to interpret the large, heterogeneous data sets that are available from diverse sources. With an order-of-magnitude increase in the amount of data from a wide variety of technical, textual, and historical sources there is a vital need to apply advanced computer technologies to support all-source analysis. There are techniques of data warehousing, data mining, and data analysis that can provide analysts with tools that will expedite their extracting useable information from the huge amounts of data to which they have access. Computerized tools can aid analysts by integrating heterogeneous data, evaluating diverse data streams, automating retrieval of database information, prioritizing inputs, reconciling conflicting data, doing preliminary interpretations, discovering patterns or trends in data, and automating some of the simpler prescreening tasks that are time consuming and tedious. Thus knowledge discovery technologies can provide a foundation of support for the analyst. Rather than spending time sifting through often irrelevant information, analysts could use their specialized skills in a focused, productive fashion. This would allow them to make their analytical judgments with more confidence and spend more of their time doing what they do best.
NTIS
Computer Systems Design; Data Flow Analysis; Data Bases; Information Retrieval; Data Processing; Data Base Management Systems

19990103598 NASA Goddard Space Flight Center, Greenbelt, MD USA
Technology Assessment of High Capacity Data Storage Systems: Can We Avoid a Data Survivability Crisis?
Halem, Milton, NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 20-22 Jun. 1999, Monterey, CA, USA; Sponsored by National Storage Industry Consortium; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
     In a recent address at the California Science Center in Los Angeles, Vice President Al Gore articulated a Digital Earth Vision. That vision spoke to developing a multi-resolution, three-dimensional visual representation of the planet into which we can roam and zoom into vast quantities of embedded geo-referenced data. The vision was not limited to moving through space, but also allowing travel over a time-line, which can be set for days, years, centuries, or even geological epochs. A working group of Federal Agencies, developing a coordinated program to implement the Vice President's vision, developed the definition of the Digital Earth as a visual representation of our planet that enables a person to explore and interact with the vast amounts of natural and cultural geo-referenced information gathered about the Earth. One of the challenges identified by the agencies was whether the technology existed that would be available to permanently store and deliver all the digital data that enterprises might want to save for decades and centuries. Satellite digital data is growing by Moore's Law as is the growth of computer generated data. Similarly,

the density of digital storage media in our information-intensive society is also increasing by a factor of four every three years. The technological bottleneck is that the bandwidth for transferring data is only growing at a factor of four every nine years. This implies that the migration of data to viable long-term storage is growing more slowly. The implication is that older data stored on increasingly obsolete media are at considerable risk if they cannot be continuously migrated to media with longer life times. Another problem occurs when the software and hardware systems for which the media were designed are no longer serviced by their manufacturers. Many instances exist where support for these systems are phased out after mergers or even in going out of business. In addition, survivability of older media can suffer from physical breakdown of components (e.g. tapes simply lose their magnetic properties after a long time in storage). As a result, a potential data survivability crisis is emerging. The scale of the crisis is comparable to that facing the Social Security System. Sometime in one or two decades, the exponential growth of data will become so great that many enterprises will not be able to migrate through their data to more permanent media during the lifetime of the media on which it resides. This will result in significant losses of data and their resultant impacts. to avoid this crisis, we need to plan and devote greater financial and intellectual resources are needed for the development and refinement of new storage media and migration technologies in order to preserve all data any organization determines worth saving permanently. This talk will explore technological solutions and suggested recommendations to address this technological data crisis.
Author

Data Storage; Digital Data; Security; Technology Assessment; Magnetic Storage

19990104369 Wisconsin Univ., Space Science and Engineering Center, Madison, WI USA
Intercomparison, Visualization, and Analysis Testbed System for EOS Global Assimilated Datasets and Satellite Data
Final Report
1996; In English; Original contains color illustrations
Contract(s)/Grant(s): NAG5-2906; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Space Science and Engineering Center (SSEC) of the University of Wisconsin - Madison had two primary goals for NASA grant NAG5-2906. (1) Collaborate with scientists at NASA Goddard Space Flight Center (GSFC) to integrate SSEC's Vis5D software into NASA's Interactive Image Spread Sheet (IISS). Vis5D provides environmental modelers with interactive three-dimensional visualization of their model output. Integration of Vis5D with the IISS would give 3-D graphics capability to the iiss. (2) Make improvements in Vis5D as required by scientists at the NASA Data Assimilation Office (DAO). We were successful in both of these goals. Furthermore, the generic approach taken to achieving the first goal has enabled Vis5D to be integrated into many other software systems.
Author

Software Engineering; Environment Models; Imaging Techniques; Three Dimensional Models; Environment Simulation; Computer Graphics; Applications Programs (Computers)

19990105808 General Accounting Office, Accounting and Information Management Div., Washington, DC USA
Report to the Secretary of Defense. DOD Information Security: Serious Weaknesses Continue to Place Defense Operations at Risk
Aug. 1999; 30p; In English; Report to the Secretary of Defense.
Report No.(s): AD-A367257; GAO/AIMD-99-107; B-282190; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Department of Defense (DOD) relies on a vast and complex information infrastructure to support critical operations such as designing weapons, identifying and tracking enemy targets, paying soldiers, mobilizing reservists, and managing supplies. Indeed, its warfighting capability depends upon computer-based telecommunications networks and information systems. In recent years, numerous internal and external evaluations have identified weaknesses in information security that could seriously jeopardize DOD's operations and compromise the confidentiality, integrity or availability of sensitive information. This report summarizes the results of our latest review of information security at DOD. In May 1996, we reported that external attacks on DOD computer systems were a serious and growing threat According to DOD officials, attackers had stolen, modified, and destroyed both data and software. They had installed "back doors" that circumvented normal system protection and allowed attackers unauthorized future access. They had shut down and crashed entire systems and networks. In September 1996, we issued a report, based on detailed analyses and testing of general computer controls, that identified pervasive vulnerabilities in DOD information systems. We had found that authorized users could also exploit the same vulnerabilities that made external attacks possible to commit fraud or other improper or malicious acts.
DTIC

Information Systems; Computer Information Security; Selective Dissemination of Information; Electronic Warfare; Combat

NASA Goddard Space Flight Center, Greenbelt, MD USA

Current and Future Plans of the NASA Data Assimilation Office (DAO)

Atlas, Robert, NASA Goddard Space Flight Center, USA; Hou, Arthur, NASA Goddard Space Flight Center, USA; Schubert, Siegfried, NASA Goddard Space Flight Center, USA; 1999; 1p; In English; 2nd; Reanalyses, 23-27 Aug. 1999, Reading, UK; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The mission of the Data Assimilation Office (DAO) is to advance the state of the art of data assimilation and produce research-quality assimilated data sets which make optimal use of space-based observations. Development efforts over the last few years have focused on delivering a production data assimilation system in support of NASA's Terra platform. That system, called the Goddard Earth Observing System - version 2 or GEOS-2, represents a major upgrade to the baseline GEOS-1 system employed in NASA's first reanalysis effort. GEOS-2 includes a physical-space three dimensional variational analysis algorithm (the Physical-space Statistical Analysis System or PSAS) and numerous improvements to the general circulation model. The latter include a Soil-Vegetation-Atmosphere Transfer (SVAT) land surface scheme, a level 2.5 moist turbulence scheme and new Short Wave (SW) and Long Wave (LW) radiation code. The system also includes an off-line ozone assimilation system, and the capability to assimilate scatterometer surface winds, and TIROS Operational Vertical Sounder (TOVS) and Special Sensor Microwave Imager (SSM/I) moisture data. GEOS-2 is currently run at 1 degree horizontal resolution and 48 levels extending to O.Olmb. Experimental versions of GEOS-2 are run with a global stretched grid allowing enhanced (e.g. 1/4 deg) regional resolution. Other capabilities being developed include, the assimilation of Tropical Rainfall Measuring Mission (TRMM) precipitation and Global Positioning System (GPS) data, an off-line land surface assimilation system, and a retrospective analysis scheme. The DAO is also engaged in a number of collaborative efforts to help accelerate the development of the next generation data assimilation system. These include, a joint modeling effort between the DAO and NCAR/CGDD to develop a new Global Circulation Model (GCM), and a Department of Energy Lawrence Livermore National Laboratory (DOE/LLNL) collaboration on model parallelization. Plans for the next reanalysis will be discussed in the context of current and near term system quality and computing capabilities, and the need for multiple reanalysis products.
Author
Data Systems; Earth Observing System (EOS); Vegetation; Research; Computer Systems Performance; Reliability; Earth Observations (From Space)

84
LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

Norwegian Defence Research Establishment, Kjeller, Norway

Russia and the European Institutions *Russland og de Europeiske Institusjoner*

Kjolberg, Anders, Norwegian Defence Research Establishment, Norway; Jun. 10, 1999; 69p; In Norwegian; Original contains color illustrations

Contract(s)/Grant(s): Proj. FFISYS/733/410

Report No.(s): FFI/RAPPORT-99/00932; ISBN 82-464-0352-4; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

European politics after the Cold War is dominated by the Western powers. Western norms for political and economic behaviour have been accepted all over Europe, and Western political institutions like NATO and EU are much more important than all European institutions like OSCE. Membership in the important institutions, however, is restricted, and new members have to be accepted by the Western powers. Russia therefore is an outsider in the new Europe with limited influence on European developments. Russia sought to influence European politics by joining the key institutions, but was met with a cold shoulder by the Western powers who feared and fears that Russian membership could seriously weaken those institutions, making them unable to deal with security challenges. Cooperation with Russia, however, is necessary to build a more peaceful and stable Europe. The balancing between the need to involve Russia and the fear of too close involvement is both very difficult and very important for future European security

Author

Security; Politics; Stability; International Relations

19990104062 Norwegian Defence Research Establishment, Kjeller, Norway

Europeanization of Security Policy: NATO and OSCE in the Field of Gravity of EU Integration *Europeisering av Sikker-hetspolitikken: NATO og OSSE i EU-Prosessens Gravitasjonsfelt*

Martin, Saeter, Norwegian Defence Research Establishment, Norway; Aug. 24, 1999; 64p; In Dutch

Contract(s)/Grant(s): Proj. FFISYS/733/161.1

Report No.(s): FFI/RAPPORT-99/04175; ISNB 82-464-0361-3; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

     'Europeanization' may be seen as the transfer of authority and competence from the national level to the European one in the context of regional integration. The concept may also be used to describe a rearrangement at the Atlantic level in the sense of assigning to Europe a greater role within NATO. Finally, 'europeanization' may also be conceived as linked to the strengthening of all-European frameworks of security and cooperation like the OSCE, including also Russia. Elements from all three perspectives have been interacting in European politics since the early 1950s. Their relative strength has been shifting as a consequence of changing power constellations. The end of the Cold War at first seemed to imply a kind of cooperative synthesis, but by the middle of the 1990s conflicts had reappeared both between the Atlantic and the all-European perspective and between the Atlantic and the EU-centered one. For a couple of years, the US-led and NATO-based Atlantic perspective seemed to prevail. But since the autumn of 1998, there has taken place a seemingly decisive strengthening of the role of the EU as the most dynamic center of European politics also as regards security and defense. The Washington NATO summit in April 1999 explicitly endorsed a greater EU 'autonomy' in the military field. and important decisions to this effect were taken by the Cologne meeting of the European Council in June this year. Part of the strengthened process of EU-centered europeanization is also the inclusion of Russia in the perspective of 'ever-closer cooperation' and 'security partnership', as expressed in the adopted 'common strategy' on this country. In this way, the all-European perspective will henceforth clearly have to be defined more or less as an extension of the EU-centered process of integration. The future role of NATO in the all-European context has become more uncertain.

Author

Europe; North Atlantic Treaty Organization (NATO); International Cooperation; Peacetime

85
URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation. For related information see also 03 Air Transportation and Safety, 16 Space Transportation, and 44 Energy Production and Conversion.

19990103928 American Trade Initiatives, Inc., Alexandria, VA USA

Innovative Traffic Control: Technology Practice in Europe. International Technology Exchange Program

Tignor, S. C.; Brown, L. L.; Butner, J. L.; Cunard, R.; Davis, S. C.; Aug. 1999; 126p; In English; Original contains color illustrations

Report No.(s): PB99-167629; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

     This summary report describes a may 1998 transportation technology scanning tour of four European countries. The tour was co-sponsored by FHWA, AASHTO, and TRB. The tour team consisted of 10 traffic engineers who visited England, France, Germany, and Sweden to observe traffic control devices and methodology and to determine if any European practices should and could be recommended for use in the USA. This report is organized into five key chapters: Traffic Control Devices, Freeway Control, Operational Practices, Information Management, and Administrative Practices. Among the devices and practices recommended for further study for U.S. adoption are specific freeway pavement markings, variable speed control, lane control signals, intelligent speed adaptation, innovative intersection control, and variable message signs that incorporate pictograms. The report includes statements for proposed research problems.

NTIS

Control Equipment; Speed Control; Information Management

19990105633 Lunar and Planetary Inst., Houston, TX USA
Second Annual HEDS-UP Forum
Duke, Michael B., Editor, Lunar and Planetary Inst., USA; Second Annual HEDS-UP Forum; 1999; 284p; In English; 2nd, 6-7 May 1999, Houston, TX, USA; See also 19990105634 through 19990105646
Contract(s)/Grant(s): NASW-4574
Report No.(s): LPI-Contrib-979; Copyright; Avail: CASI; A13, Hardcopy; A03, Microfiche

HEDS-UP (Human Exploration and Development of Space-University Partners) conducted its second annual forum on May 6-7, 1999, at the Lunar and Planetary Institute in Houston. This year, the topics focused on human exploration of Mars, including considerations ranging from systems analysis of the transportation and surface architecture to very detailed considerations of surface elements such as greenhouses, rovers, and EVA suits. Ten undergraduate projects and four graduate level projects were presented with a total of 13 universities from around the country. Over 200 students participated on the study teams and nearly 100 students attended the forum meeting. The overall quality of reports and presentations was extremely high, with most projects requiring that the students dig into space systems concepts, designs, and technologies in detail. University team outreach projects also reached approximately 1500 people through articles and Web sites developed by the students. Several of the teams had NASA or industry mentors and included visits to NASA centers as part of their class activities. Awards were made to the three top undergraduate teams and the top team of graduate students. The first-place award went to a team from Wichita State University, Wichita, Kansas. Their faculty advisor was Dr. Gawad Nagati of the Department of Aerospace Engineering. Second place went to a team from the California Institute of Technology, Pasadena, California, with Dr. James Burke of the jet Propulsion Laboratory as advisor. Third place was awarded to the University of Houston in Houston, Texas, where Dr. David Zimmerman was the faculty sponsor. The graduate award was made to a team from the University of Maryland, College Park, Maryland, under the sponsorship of Dr. David Akin.
Derived from text
Mars Exploration; Mars Missions; Mars Global Surveyor; Greenhouses; Transportation; Conferences

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

19990099687 NASA Marshall Space Flight Center, Huntsville, AL USA
XTE J1550-564; GRB 990123
Harmon, B. A., NASA Marshall Space Flight Center, USA; Finger, M. H., NASA Marshall Space Flight Center, USA; McCollough, M. L., NASA Marshall Space Flight Center, USA; Zhang, S. N., NASA Marshall Space Flight Center, USA; Paciesas, W. S., NASA Marshall Space Flight Center, USA; Wilson, C. A., NASA Marshall Space Flight Center, USA; International Astronomical Union Conference; 1999; ISSN 0081-0304; In English, 1999, Cambridge, MA, USA; Sponsored by International Astronomical Union, Netherlands
Report No.(s): Circular-7098; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The x-ray transient XTE Jl550-564 (IAUC 7008) was detected in Burst and Transient Source Experiment (BATSE) data beginning on Jan. 21. As of Jan. 23. the one-day averaged flux was 300 mCrab (+/- 20 percent, 20-100 keV), with a hard spectrum (power-law photon-number index -2.3 +/- 0.2). This is a reflare in hard x-rays, following the primary outburst in 1998 Sept.-Oct. (IAUC 7010). The source has been active in soft x-rays (2-12 keV) since about Dec. 18, according to observations by the Rossi X-ray Timing Explorer ASM.
Author
Gamma Ray Observatory; Gamma Ray Bursts; X Rays; Detection; Gamma Ray Astronomy

19990100649 NASA Goddard Space Flight Center, Greenbelt, MD USA
A Highly Doppler Blueshifted Fe-K Emission Line in the High-Redshift QSO PKS 2149-306
Yaqoob, Tahir, NASA Goddard Space Flight Center, USA; George, I. M., NASA Goddard Space Flight Center, USA; Nandra, K., NASA Goddard Space Flight Center, USA; Turner, T. J., NASA Goddard Space Flight Center, USA; Zobair, S., NASA Goddard Space Flight Center, USA; Selemitsos, P. J., NASA Goddard Space Flight Center, USA; [1999]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We report the results from an ASCA observation of the high-luminosity, radioloud quasar PKS 2149-306 (redshift 2.345), covering the approximately 1.7 - 30 keV band in the quasar-frame. We find the source to have a luminosity of approximately 6 x 10(exp 47) ergs/s in the 2 - 10 keV band (quasar frame). We detect an emission line centered at approximately 17 keV in the quasar frame. Line emission at this energy has not been observed in any other active galaxy or quasar to date. We present evidence rejecting the possibility that this line is the result of instrumental artifacts, or a serendipitous source. The most likely explanation is blueshifted Fe-K emission (the equivalent width, is EW approximately 300 +/- 200 eV, quasar frame). Bulk velocities of the order of 0.75c are implied by the data. We show that Fe-K line photons originating in an accretion disk and Compton-scattering off a leptonic jet aligned along the disk axis can account for the emission line. Curiously. if the emission-line feature recently discovered in another quasar (PKS 0637-752, z = 0.654) at 1.6 keV in the quasar frame, is due to blueshifted OVII emission, the Doppler blueshifting factor in both quasars is similar (approximately 2.7 - 2.8).
Author
Quasars; Active Galactic Nuclei; Active Galaxies; Accretion Disks; Emission Spectra; Line Spectra

19990100655 Columbia Univ., Depts. of Astronomy and Physics, New York, NY USA
Search for Obscured Nucleus in a Luminous IRAS Galaxy NGC 6240 *Final Report, 1 Feb. 1998 - 31 Jan. 1999*
Leighly, Karen, Columbia Univ., USA; October 1999; 24p; In English; Sponsored by Japan Society for the Promotion of Science, Japan
Contract(s)/Grant(s): NAG5-6921; NAG5-7971
Report No.(s): CAL-3161; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

IRAS discovered very luminous objects which emit the vast majority of their radiation in the infrared wavelength. The energy source of such a tremendous amount of emission is not understood. Starburst and active galactic nuclei (AGN) are thought to be the origin of their power. X-ray observations are expected to be able to reveal the characteristics of the AGN component. However, some are very X-ray quiet, because the AGN is thought to be obscured by a large column density. In order to determine the primary luminosity of the nucleus, we need an X-ray observation with a wide energy band at least up to several tens of keV. We propose to observe NGC 6240, one of the luminous IRAS galaxies, to investigate the characteristics of its AGN, which must be obscured by large column density.
Author
Active Galactic Nuclei; Galactic Radiation; Galaxies; Starburst Galaxies

19990100879 NASA Marshall Space Flight Center, Huntsville, AL USA
Next Generation Space Telescope Ultra-Lightweight Mirror Program
Bilbro, James W., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 10th; School on Quantum Electronics Laser Physics and Applications, 21-25 Sep. 1998, Varna, Bulgaria; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Next Generation Space Telescope is currently envisioned as a eight meter diameter cryogenic deployable telescope that will operate at the earth sun libration point L2. A number of different designs are being examined within NASA and under industry studies by Ball Aerospace, Lockheed-Martin and TRW. Although these designs differ in many respects, they all require significant advancements in the state-of-the-art with respect to large diameter, ultra-lightweight, mirrors. The purpose of this paper is to provide insight into the current status of the mirror development program NGST is a tremendously ambitious undertaking that sets the mark for new NASA missions. In order to achieve the weight, cost and performance requirements of NGST, the primary mirror must be made lighter, cheaper and better than anything that has ever been done. In order to accomplish this an aggressive technology program has been put in place. The scope of the program was determined by examining historically what has been accomplished; assessing recent technological advances in fabrication and testing; and evaluating the effect of these advances relative to enabling the manufacture of lightweight mirrors that meet NGST requirements. As it is currently envisioned, the primary mirror for NGST is on the order of eight meters in diameter, it is to be diffraction limited at a wave length of 2 microns and has an overall weight requirement of 15 kilograms per square meter. Two large scale demonstration projects are under way along with a number of smaller scale demonstrations on a variety of mirror materials and concepts. The University of Arizona (UA) mirror concept is based around a 2mm thick Borosilicate glass face sheet mounted to a composite backplane structure via actuators for mirror figure correction. The Composite Optics Inc.(COI) concept consists of a 3.2mm thick Zerodur face sheet bonded to a composite support structure which in turn is mounted to a composite backplane structure via actuators for mirror phasing. These mirrors are due to be performance tested in ambient conditions in the fall of '98, and cryogenically tested in the spring of '99. The smaller scale efforts include the following: Beryllium is being investigated at Ball Aerospace, Electroform nickel is being investigated in-house at MSFC, Chemical Vapor Deposition (CVD) Silicon Carbide (SiC) is being investigated at Morton International Silicon mirrors are being investigated at Schafer, Carbon Fiber Reinforced Silicon Carbide (CSIC) is being investigated at IABG. SiC at SSG, Composite mirrors at COI, pyrolyzed graphite mirrors at Ultramet, reaction bonded SiC mirrors at Xinetics, along with

techniques for lightweighting using waterjets at Waterjet Technology Inc. are all being investigated under the Small Business innovative Research Program SBIR program. A procurement for a third large scale demonstration (nominally 1.5m in diameter) is being planned for release this fall.

Author

Mirrors; Optical Materials; Spaceborne Telescopes

19990100920 NASA Marshall Space Flight Center, Huntsville, AL USA

A Multiphase Model for the Intracluster Medium

Nagai, Daisuke, NASA Marshall Space Flight Center, USA; Sulkanen, Martin E., NASA Marshall Space Flight Center, USA; Evrard, August E., NASA Marshall Space Flight Center, USA; 1999; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Constraints on the clustered mass density of the universe derived from the observed population mean intracluster gas fraction of x-ray clusters may be biased by reliance on a single-phase assumption for the thermodynamic structure of the intracluster medium (ICM). We propose a descriptive model for multiphase structure in which a spherically symmetric ICM contains isobaric density perturbations with a radially dependent variance. Fixing the x-ray emission and emission weighted temperature, we explore two independently observable signatures of the model in the parameter space. For bremsstrahlung dominated emission, the central Sunyaev-Zel'dovich (SZ) decrement in the multiphase case is increased over the single-phase case and multiphase x-ray spectra in the range 0.1-20 keV are flatter in the continuum and exhibit stronger low energy emission lines than their single-phase counterpart. We quantify these effects for a fiducial 10e8 K cluster and demonstrate how the combination of SZ and x-ray spectroscopy can be used to identify a preferred location in the plane of the model parameter space. From these parameters the correct value of mean intracluster gas fraction in the multiphase model results, allowing an unbiased estimate of clustered mass density to he recovered.

Author

Galactic Clusters; Galaxies; X Ray Astronomy; Stellar Models

19990100965 NASA Marshall Space Flight Center, Huntsville, AL USA

Mission Planning for the CHANDRA X-Ray Observatory

Mullins, Larry D., NASA Marshall Space Flight Center, USA; Stone, Russell, L., NASA Marshall Space Flight Center, USA; Evans, Steven W., NASA Marshall Space Flight Center, USA; [1999]; 13p; In English; Astrodynamics Specialists Conference, 16-19 Aug. 1999, Girdwood, AK, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The CHANDRA x-ray observatory started life as the Advanced X-ray Facility (AXAF) but was renamed Chandra in December of 1998 at the of a nationwide contest by NASA to name the new observatory. The honors the Nobel Prize winning astrophysicist S. Chandrasekar who astrophysics at the University of Chicago for more than 50 years, following graduate studies at Cambridge University in England. The observatory has been under construction for a decade under the management of the Observatory observatory, Projects office at the Marshall Space Flight Center; the same office that oversaw the construction of the Hubble Space Telescope and the Compton Gamma Ray Observatory. This observatory is a member of NASA's great observatory series of missions of which Hubble and Compton are members. This paper describes the mission planning that was conducted at MSFC to design the orbit and launch window that would permit the new observatory to function properly.

Author (revised)

Mission Planning; X Ray Astrophysics Facility; Launch Windows; Research Facilities

19990101873 Space Telescope Science Inst., Baltimore, MD USA

HRI Observations of Balmer Dominated Filaments in the SNR RCW86 *Final Report*

Long, Knox S., Space Telescope Science Inst., USA; Sep. 27, 1999; 4p; In English

Contract(s)/Grant(s): NAG5-4825; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The objective of this project was to use the ROSAT HRI to study the recently discovered optical Balmer-dominated filaments in the young SNR R-CW86. The observations provide complete high-resolution X-ray coverage of the shell of the SNR. These X-ray observations are combined with new optical observations (both imaging and spectroscopic), and new high resolution radio observations to provide a better overall understanding of the state of the remnant (Sedov or reverse shock), its history (as the possible SNR of SN 185 AD), and the physics of non-radiative shocks.

Author

Balmer Series; Visual Observation; Radio Observation; Solar Prominences

19990103048 National Optical Astronomy Observatories, Tucson, AZ USA

The Hubble Space Telescope Key Project on the Extragalactic Distance Scale XXIV: The Calibration of Tully-Fisher Relations and the Value of the Hubble Constant

Sakai, Shoko, Kitt Peak National Observatory, USA; Mould, Jeremy R., Australian National Univ., Australia; Hughes, Shaun M. G., Institute of Astronomy, UK; Huchra, John P., Harvard-Smithsonian Center for Astrophysics, USA; Macri, Lucas M., Harvard-Smithsonian Center for Astrophysics, USA; Kennicutt, Robert C., Jr., Arizona Univ., USA; Gibson, Brad K., Colorado Univ., USA; Ferrarese, Laura, California Inst. of Tech., USA; Freedman, Wendy L., Carnegie Institution of Washington, USA; Han, Mingsheng, Avanti Corp., USA; September 1999; 40p; In English

This paper presents the calibration of BVRIH-0.5 Tully-Fisher relations based on Cepheid distances to 21 galaxies within 25 Mpc, and 23 clusters within 10,000 km/s. These relations have been applied to several distant cluster surveys in order to derive a value for the Hubble constant, H(sub 0), mainly concentrating on an I-band all-sky survey by Giovanelli and collaborators which consisted of total I magnitudes and 50% linewidth data for approx. 550 galaxies in 16 clusters. For comparison, we also derive the values of H(sub 0) using surveys in B-band and V-band by Bothun and collaborators, and in H-band by Aaronson and collaborators. Careful comparisons with various other databases from literature suggest that the H-band data, whose magnitudes are isophotal magnitudes extrapolated from aperture magnitudes rather than total magnitudes, are subject to systematic uncertainties. Taking a weighted average of the estimates of Hubble constants from four surveys, we obtain H(sub 0) = 71 +/- 4 (random) +/- 7 (systematic) We have also investigated how various systematic uncertainties affect the value of HO such as the internal extinction correction method used, Tully-Fisher slopes and shapes, a possible metallicity dependence of the Cepheid period-luminosity relation and cluster population incompleteness bias.
Author
Calibrating; Hubble Space Telescope; Hubble Constant; Cepheid Variables; Correction

19990103099 NASA Marshall Space Flight Center, Huntsville, AL USA

SGR 1900+14

Hurley, K., NASA Marshall Space Flight Center, USA; Woods, P., Alabama Univ., USA; Kippen, R. M., Alabama Univ., USA; Kouveliotou, C., Universities Space Research Association, USA; Briggs, M. S., Alabama Univ., USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

SGR 1900+14 soft gamma-ray repeater has entered an extraordinary new phase of activity with a previously unobserved frequency and intensity of bursts. Activity began on May 26 and has continued at least through May 30. Triangulation with Ulysses and BATSE gives a preliminary annulus whose center is at R.A. = 2lh58ml8s, Decl. = -11ol8'.4 (equinox 2000.0), and whose radius is 47.269 +/- 0.019 deg. This annulus includes the network synthesis error box (Hurley et al. 1994, Ap.J. 431, L31), the ROSAT source proposed as a possible quiescent x-ray counterpart to the soft repeater, and the peculiar double M star system coincident with the ROSAT source. As all these locations are mutually consistent, we conclude that the ROSAT source and M star system are indeed the counterparts to the soft gamma-ray repeater, and urge that observations at other wavelengths be undertaken immediately, while the source remains active. An image may be found at http://ssl.berkeley.edu/ipn3/sgrl9OO+l4/. On May 30, BATSE triggered on an extremely intense outburst from this source that comprised at least 38 bursts of varying intensity and duration; the series of bursts started at May 30.37759 UT and lasted for about 350 s. The peak flux of each of the three major bursts in the series is 1.1 x lOE-4 erg cmE-2 sE-1 (between 25 and 300 keV, integrated for 128 ms). Assuming a distance of about 12 kpc for SGR 1900+14, this corresponds to a luminosity of about 2 X 10(exp 42) ergs / second for each burst. This bunching of emission is very similar to the behavior of SGR 1806-20 as detected with the Rossi X-ray Timing explorer in 1996. Overall, between May 26 and June 1, we have detected over 50 bursts from SGR 1900+4. The frequency and intensity of emissions are unlike any previously seen behavior from this source. Follow-up observations at infrared and radio wavelengths, while the source is still active are encouraged.
Author
Bunching; Gamma Ray Bursts; Gamma Rays; Luminosity; M Stars; Peculiar Stars; Gamma Ray Astronomy

19990103593 NASA Goddard Space Flight Center, Greenbelt, MD USA

Titan

Flasar, F. M., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; The Solar System and Circumstellar Dust Disks: Prospects for SIRTF, 18-20 Aug. 1999, Dana Point, CA, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

With a launch in December 2001, Space Infrared Telescope Facility (SIRTF) can observe Titan in the interval after Infrared Space Observatory (ISO) but before the onset of observations by Cassini. by virtue of its broad spectral coverage in the thermal

infrared, 10-180 micron, its moderately high spectral resolution, approaching lambda/delta lambda=600 over part of this wavelength range, and the very high sensitivity of its helium- cooled detectors, the Infrared Spectrometer (IRS) and MIPS on SIRTF can address several issues raised through earlier observations by the Voyager IRIS experiment and by ISO. These include, for example, a better characterization of the vertical distribution of water in Titan's middle and upper atmospheres and the discovery of new compounds, such as allene or proprionitrile. This talk will address the temperature- and composition-sounding capabilities of SIRTF, particularly in the context of how they will complement Cassini observations and aid in their planning.

Author

Space Infrared Telescope Facility; Titan; Water; Atmospheric Composition; Satellite Atmospheres; Spaceborne Astronomy

19990103950 NASA Goddard Space Flight Center, Greenbelt, MD USA

AKN 564: An Unusual Component in the X-ray Spectra of NLSy1 Galaxies

Turner, T. J., NASA Goddard Space Flight Center, USA; George, I. M., NASA Goddard Space Flight Center, USA; Netzer, Hagai, Tel-Aviv Univ., Ramat-Aviv, Israel; [1999]; 16p; In English

Contract(s)/Grant(s): NAG5-7385; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We present an ASCA observation of the narrow-line Seyfert l (NLSyl) Arakelian 564. The X-ray light curve shows rapid variability, but no evidence for energy-dependence to these variations, within the 0.6 - 10 keV bandpass. A strong (EW approximately 70 eV) spectral feature is observed close to 1 keV. A similar feature has been observed in TON S180, another member of the NLSyl class of objects, but has not been observed in broad-line Seyfert galaxies. The feature energy suggests a large contribution from Fe L-shell lines but its intensity is difficult to explain in terms of emission and/or absorption from photoionized gas. The models which predict most emission at 1 keV are characterized by extreme values of column density, Fe abundance and ionization parameter. Models based on gas in thermal equilibrium with kT approximately l keV provide an alternative parameterization of the soft spectrum. The latter may be interpreted as the hot intercloud medium, undergoing rapid cooling and producing strong Fe L-shell recombination lines. In all cases the physical conditions are rather different from those observed in broad-line Seyferts. The hard X-ray spectrum shows a broad and asymmetric Fe K(alpha) line of large equivalent width (approximately 550 eV) suggestive of significant emission from the inner accretion disk. The profile can be explained by a neutral disk viewed at approximately 60 deg to the line-of-sight, contrary to the hypothesis that NLSyls are viewed pole-on. The large EW of this line, the strong 1 keV emission and the strong optical Fe emission lines all suggest an extreme Fe abundance in this and perhaps other NLSyls.

Author

X Ray Astronomy; X Ray Spectra; Seyfert Galaxies

19990104363 NASA Marshall Space Flight Center, Huntsville, AL USA

Discovery and Orbital Determination of the Transient X-Ray Pulsar GRO J1750-27

Scott, D. M., Universities Space Research Association, USA; Finger, M. H., Universities Space Research Association, USA; Wilson, R. B., NASA Marshall Space Flight Center, USA; Koh, D. T., California Inst. of Tech., USA; Prince, T. A., California Inst. of Tech., USA; Vaughan, B. A., California Inst. of Tech., USA; Chakrabarty, D., Massachusetts Inst. of Tech., USA; [1997]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We report on the discovery and hard X-ray (20-70 keV) observations of the 4.45 second period transient X-ray pulsar GRO J1750-27 with the BATSE all-sky monitor on board CCRO. A relatively faint outburst (is less than 30 mCrab peak) lasting at least 60 days was observed during which the spin-up rate peaked at 38 pHz/sec and was correlated with the pulsed intensity. An orbit with a period of 29.8 days was found. The large spin-up rate, spin period and orbital period together suggest that accretion is occurring from a disk and that the outburst is a 'giant' outburst typical of a Be/X-ray transient system. No optical counterpart has been reported yet.

Author

Pulsars; Gamma Ray Sources (Astronomy); Gamma Ray Astronomy; Galactic Radiation; X Ray Stars; Accretion Disks

19990104370 NASA Goddard Space Flight Center, Greenbelt, MD USA

All-Sky Search for Transient Sources near 0.5 MeV with the Burst and Transient Source Experiment (BATSE)

Smith, D. M., Maryland Univ., USA; Leventhal, M., Maryland Univ., USA; Cavallo, R., Maryland Univ., USA; Gehrels, N., NASA Goddard Space Flight Center, USA; Tueller, J., NASA Goddard Space Flight Center, USA; Fishman, G., NASA Marshall Space Flight Center, USA; Astrophysical Journal; Nov. 10, 1996; Volume 471, pp. 783-795; In English

Contract(s)/Grant(s): NAG5-2296; NAG5-2380; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

We present a search for bright, transient emission lines near 0.5 MeV in nearly two years of data from the Burst and Transient Source Experiment (BATSE) on the Compton Gamma-Ray Observatory, Such features have been reported from black hole candi-

dates Nova Muscae and 1E 1740.7-2942 and from the Crab, lasting for about 1 day. Our survey covers the whole sky and is sensitive to events with durations from 0.5-3.0 day. No transients are observed, and the systematic errors are low enough that the upper limits are significantly below the fluxes of the two most significant events previously reported.
Author
Gamma Ray Bursts; Gamma Rays; Positron Annihilation; Gamma Ray Astronomy; Galactic Bulge

19990105710 Smithsonian Astrophysical Observatory, Cambridge, MA USA
CIAO: Chandra Interactive Analysis of Observations
Fruscione, Antonella, Smithsonian Astrophysical Observatory, USA; Siemiginowska, Aneta, Smithsonian Astrophysical Observatory, USA; Noble, Michael, Smithsonian Astrophysical Observatory, USA; 1999; 1p; In English; X-Ray Astronomy 1999, Stellar Endpoints, AGN and the Diffuse X-Ray Background, 3-12 Sep. 1999, Bologna, Italy
Contract(s)/Grant(s): NAS8-39073; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
    Presentations and demonstrations of parts of CIAO, include the new GUIs developed for "FirstLook" analysis, data filtering and browsing; SHERPA, the multi-dimensional, multi-missions modelling and fitting application; CHIPS, the Chandra Imaging and Plotting System; generic data manipulation tools and other applications.
Author
Models; Imaging Techniques; Product Development; Folding Structures

19990105712 Los Alamos National Lab., NM USA
XTE Proposal #20102--"SS 433's High Energy Spectrum" *Final Report*
Band, David L., Los Alamos National Lab., USA; Blanco, P., California Univ., San Diego, USA; Rothschild, R., California Univ., San Diego, USA; Kawai, N., Institute of Physical and Chemical Research, Japan; Kotani, T., Institute of Physical and Chemical Research, Japan; Oka, T., Institute of Physical and Chemical Research, Japan; Wagner, R. M., Ohio State Univ., USA; Hjellming, R., National Radio Astronomy Observatory, USA; Rupen, M., National Radio Astronomy Observatory, USA; Brinkmann, W., Max-Planck Inst., Germany; Sep. 30, 1999; 42p; In English
Contract(s)/Grant(s): NAG5-3306; NAG5-7277; NAG5-7643; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche
    We observed the jet-producing compact binary system SS 433 with RXTE during three multiwavelength campaigns, the first in conjunction with ASCA observations, the second simultaneous with a VLA-VLBA-MERLIN campaign, and the third associated with a Nobeyama millimeter-band campaign. All these campaigns included optical observations. Occurring at different jet precession and binary phases, the observations also monitored the system during a radio flare. The data provide SS 433's X-ray spectrum over more than an energy decade, and track the spectral variations as the X-ray source was partially eclipsed. The continuum can be modeled as a power law with an exponential cutoff, which can be detected to approximately 50 keV. Strong line emission is evident in the 5-10 keV range which can be modeled as a broad line whose energy is precession independent and a narrow line whose energy does vary with jet precession phase; this line model is clearly an over simplification since the PCA does not have sufficient energy resolution to detect the lines ASCA observed. The eclipses are deeper at high energy and at jet precession phases when the jets are more inclined towards and away from us. A large radio flare occurred between two sets of X-ray monitoring observations; an X-ray observation at the peak of the flare found a softer spectrum with a flux approximately 1/3 that of the quiescent level.
Author
Visual Observation; X Ray Astronomy; X Ray Binaries; X Ray Sources

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ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust. For related information see also 75 Plasma Physics.

19990100646 NASA Goddard Space Flight Center, Greenbelt, MD USA
Interplanetary Fast Shocks and Associated Drivers Observed through the Twenty-Third Solar Minimum by WIND Over its First 2.5 Years
Mariani, F., Universita' Tor Vergata, Italy; Berdichevsky, D., NASA Goddard Space Flight Center, USA; Szabo, A., NASA Goddard Space Flight Center, USA; Lepping, R. P., NASA Goddard Space Flight Center, USA; Vinas, A. F., NASA Goddard Space Flight Center, USA; Sep. 22, 1999; 52p; In English; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

A list of the interplanetary (IP) shocks observed by WIND from its launch (in November 1994) to May 1997 is presented. Forty two shocks were identified. The magnetohydrodynamic nature of the shocks is investigated, and the associated shock parameters and their uncertainties are accurately computed using a practical scheme which combines two techniques. These techniques are a combination of the "pre-averaged" magnetic-coplanarity, velocity-coplanarity, and the Abraham-Schrauner-mixed methods, on the one hand, and the Vinas and Scudder [1986] technique for solving the non-linear least-squares Rankine-Hugoniot shock equations, on the other. Within acceptable limits these two techniques generally gave the same results, with some exceptions. The reasons for the exceptions are discussed. It is found that the mean strength and rate of occurrence of the shocks appears to correlated with the solar cycle. Both showed a decrease in 1996 coincident with the time of the lowest ultraviolet solar radiance, indicative of solar minimum and start of solar cycle 23, which began around June 1996. Eighteen shocks appeared to be associated with corotating interaction regions (CIRs). The distribution of their shock normals showed a mean direction peaking in the ecliptic plane and with a longitude (phi(sub n)) in that plane between perpendicular to the Parker spiral and radial from the Sun. When grouped according to the sense of the direction of propagation of the shocks the mean azimuthal (longitude) angle in GSE coordinates was approximately 194 deg for the fast-forward and approximately 20 deg for the fast-reverse shocks. Another 16 shocks were determined to be driven by solar transients, including magnetic clouds. These shocks had a broader distribution of normal directions than those of the CIR cases with a mean direction close to the Sun-Earth line. Eight shocks of unknown origin had normal orientation well off the ecliptic plane. No shock propagated with longitude phi(sub n) is greater than = 220 +/- 10 deg, this would suggest strong hindrance to the propagation of shocks contra a rather tightly winding Parker spiral. Examination of the obliquity angle theta(sub Bn) (that between the shock normal and the upstream interplanetary magnetic field) for the full set of shocks revealed that about 58% was quasi-perpendicular, and some were very nearly perpendicular. About 32% of the shocks were oblique, and the rest (only 10%) were quasi-parallel, with one on Dec. 9, 1996 that showed field pulsations. Small uncertainty in the estimated angle theta(sub Bn) was obtained for about 10 shocks with magnetosonic Mach numbers between 1 and 2, hopefully significantly contributing to studies researching particle acceleration mechanisms at IP shocks, and to investigations where accurate values of theta(sub Bn) are crucial.
Author

Interplanetary Magnetic Fields; Magnetic Clouds; Solar Activity Effects; Solar Cycles; Sun; Rankine-Hugoniot Relation; Hugoniot Equation of State; Shock Wave Propagation

19990100881 NASA Marshall Space Flight Center, Huntsville, AL USA

Galactic Superluminal Sources

Harmon, B. Alan, NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 3rd; Integral, 13-18 Sep. 1998, Taormina, Italy; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A new class of X-ray sources was clearly established with the discovery of highly relativistic radio jets from the two galactic sources GRS 1915+105 and GRO Jl655-40. Both of these objects have given us a broader view of black holes and the formation of jets, yet they also show the complexity of the accretion environment near relativistic objects. The fast apparent motion of the jets, their luminosity and variability, their high energy spectrum, and approximately scaling to the behavior of active galactic nuclei, certainly warrant the description "microquasar". A review of the observational data on these sources is presented, and where we stand on a physical picture of GRS 1915+105 and GRO J165540 as taken from multi-wavelength studies is also discussed. Other galactic sources which share some of the properties of the microquasars, and what to look for as a high energy "signature" in future observations is also discussed.
Author

Active Galactic Nuclei; Luminosity; Quasars; X Ray Sources; X Ray Astronomy; Radio Jets (Astronomy)

19990100882 NASA Marshall Space Flight Center, Huntsville, AL USA

Calibration Results for the AXAF Flux Contamination Monitor

Elsner, Ronald F., NASA Marshall Space Flight Center, USA; ODell, Stephen L., NASA Marshall Space Flight Center, USA; Ramsey, Brian D., NASA Marshall Space Flight Center, USA; Tennant, Allyn F., NASA Marshall Space Flight Center, USA; Weisskopf, Martin C., NASA Marshall Space Flight Center, USA; Kolodziejcak, J. J., NASA Marshall Space Flight Center, USA; Swartz, Douglas A., NASA Marshall Space Flight Center, USA; Engelhaupt, Darell, NASA Marshall Space Flight Center, USA; Garmire, G., NASA Marshall Space Flight Center, USA; Nousek, J., NASA Marshall Space Flight Center, USA; 1998; 1p; In English, 19-22 Jul. 1998, San Diego, CA, USA; Sponsored by International Society for Optical Engineering, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Flux Contamination Monitor (FCM) on the Advanced X-ray Astrophysics Facility (AXAF) serves the purposes of transfering the absolute flux calibration from the ground calibration at the X-Ray Calibration Facility (XRCF) at Marshall Space Flight Center to operation on orbit and of detecting any changes in molecular contamination of the High Resolution Mirror Assembly

(HRMA) between ground calibration and the post-launch activation phase. we describe the design, construction, and characterization of the FCM radioactive sources, and their placement on the Forward Contamination Cover (FCC). We present results from FCM measurements with the AXAF focal plane instruments, particularly the AXAF CCD Imaging Spectrometer (ACIS), during the ground calibration phase at XRCF in 1997. Finally, we describe the plans for FCM on-orbit measurements during observatory activation and the subsequent analysis.

Author

Calibrating; Focal Plane Devices; Imaging Spectrometers; Mirrors

19990102619 NASA Marshall Space Flight Center, Huntsville, AL USA

Low-Density Silica Xerogel Capture of Leonids Meteor Storm Dust Candidates by Stratospheric Balloon Return

Noever, David, NASA Marshall Space Flight Center, USA; Phillips, Tony, NASA Marshall Space Flight Center, USA; Horack, John, NASA Marshall Space Flight Center, USA; Myszka, Ed, NASA Marshall Space Flight Center, USA; Porter, Linda, NASA Marshall Space Flight Center, USA; Jerman, Greg, NASA Marshall Space Flight Center, USA; 1999; 1p; In English; Leonids Meteor, 12 Apr. 1999, Santa, Clara, CA, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

High altitude balloon (20 km) and low-density capture media were explored to return meteor-related dust during the November 1998 Leonids meteor storm. One 20-30 micron particle captured showed a characteristic signature of extraterrestrial origin, featuring high aluminum, magnesium and other non-volatile metals. The technique of balloon capture will be optimized for March and November 1999 reflights.

Author

Xerogels; Silicon Dioxide; Storms; Signatures; Meteoroids; Magnesium; Dust

19990103017 NASA Marshall Space Flight Center, Huntsville, AL USA

Does the UVI on Polar Detect Cosmic Snowballs?

Parks, G. K., NASA Marshall Space Flight Center, USA; Brittnacher, M. J., NASA Marshall Space Flight Center, USA; Chen, L., NASA Marshall Space Flight Center, USA; Elsen, R., NASA Marshall Space Flight Center, USA; McCarthy, M., NASA Marshall Space Flight Center, USA; Germany, G. A., NASA Marshall Space Flight Center, USA; Spann, J. F., Jr., NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Frank and Sigwarth [1997a] claim that the dark pixels observed in dayglow images obtained by the Earth sensor of the Visible Imaging System (VIS) are due to bombardment of Earth by 20 to 40 ton cosmic snowballs. We have independently studied the same one hour of VIS data Frank and Sigwarth used and have performed detailed statistical analysis of the dark pixels. The characteristics of the dark pixels from the VIS images have been compared to those obtained from the overlapping images from the Ultraviolet Imager (UVI). We find the occurrence distributions of the dark pixels, single and multiple, from VIS and UVI are nearly identical. This result cannot be explained by a -eophysical source since the two cameras have different pixel resolutions: A search for evidence of of spacecraft "wobble" motion, whose presence would indicate that the source is external to the camera, has found that pairs of dark pixel clusters are uniformly distributed in an-le and no preference is observed in the wobble direction. Instrument artifacts as the source of the dark pixels is the most likely explanation for these results. Probability estimates for the occurrence of dark pixel clusters lead us to expect coincident events of instrumental origin to occur frequently in the two cameras. The conclusion of this study is that neither VIS nor UVI provide any scientific evidence that the origin of dark pixels is geophysical.

Author

Cameras; Imaging Techniques; Pixels

19990103151 NASA Marshall Space Flight Center, Huntsville, AL USA

Calculation of Area Loss Due to Meteoroid Penetration

Cooke, William J., Jr., Computer Sciences Corp., USA; Anderson, B. Jeffrey, NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Leonid Meteoroid Storm and Satellite Threat, 27-28 Apr. 1998, Manhattan Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Simple Monte Carlo methods have been applied to the calculation of meteoroid penetration of spacecraft surfaces to account for the distributions of impact angle and velocity on the impact mechanics. Both single sheet and double sheet surfaces have been modeled. The model has been applied to several spacecraft and spacecraft concepts to evaluate light leakage into optical instruments or through sunshades. Results indicate that surfaces are less likely to be penetrated - or will be penetrated less often - than indicated by simply assuming an "average" velocity and normal impact. The reduction is typically about 40 percent. This effect

is caused by the angular dependence of the penetration mechanics. However, the probability distribution of penetrating particles is relatively broad and indicates a peak above the ballistic limit particle size associated with the average velocity case.
Author
Impact Velocity; Meteoritic Damage; Monte Carlo Method; Mathematical Models; Meteorite Collisions; Meteoroid Hazards

19990103153 NASA Marshall Space Flight Center, Huntsville, AL USA
Estimates of Leonid Storm Probabilities and Fluxes from Historical Information
Cooke, William J., Jr., Computer Sciences Corp., USA; Anderson, B. Jeffrey, NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Leonid Meteoroid Storm and Satellite Threat, 27-28 Apr. 1998, Manhattan Beach, CA, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We have analyzed accounts of Leonid storms and showers occurring near the 33 year resonance to derive probabilities of the occurrence of Leonid storms as a function of time since comet nodal passage and distance to the orbit of the particle stream. Based on this analysis, we have obtained the following storm probabilities for the coming apparition: 1997 - 33%, 1998 - 60%, 1999 - 100%, and 2000 - 25%. 95% confidence bands are also computed for these years. An expression for the Leonid storm flux is derived using a simple velocity-corrected ZHR scaling to the sporadic flux, which is then compared to that obtained from observations of the 1966 Leonid storm. The two results agree to within a factor of five, provided the Kessler meteor mass-magnitude relation is used. If the Jenniskens mass-magnitude relation is adopted, then the results are more disparate, disagreeing by a full order of magnitude. From the standpoint of spacecraft risk, it would make sense to choose the more conservative of the two relations, so the expression for the Leonid storm flux is F(sub storm) = 3x 10(exp 19) ZHR m(exp -1.3), where m, the meteoroid mass, is in grams, and the flux is in units of # /m2s. Based on the historical record, we are expecting Leonid ZHR's somewhere between 1000 and 5000 in 1998 and 1999.
Author
Leonid Meteoroids; Meteoroid Showers; Meteoroid Hazards

19990103173 NASA Marshall Space Flight Center, Huntsville, AL USA
Theories of the Universe: A One Semester Course for Honors Undergraduates
Dimmock, John O., Alabama Univ., USA; Adams, Mitzi, NASA Marshall Space Flight Center, USA; Sever, Tom, Global Hydrology and Climate Center, USA; 1999; 1p; In English; 4th; Biennial History of Astronomy, 2 Jul. 1999, Notre Dame, IN, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

For the last two years The University of Alabama in Huntsville (UAH) has delivered a one semester course entitled Theories of The Universe as a seminar for undergraduate honors students. The enrollment is limited to fifteen students to encourage a maximum amount of interaction and discussion. The course has been team-taught enlisting the support of four scientists from the NASA Marshall Space Flight Center as well as UAH faculty from the history, philosophy, biology and physics departments. The course mixes history, mythology, philosophy, religion, and, of course, science and astronomy. The course traces mankind's view of the universe and how that has changed from about 30,000 years BCE to the current observations and models. Starting with a brief history of mankind we trace the evolution of ideas including Prehistoric European, Babylonian, Egyptian, Asian, North, Central and South American, African, Chinese, Greek, Middle Ages, Copernican, Galileo, Kepler, the Renaissance and Enlightenment, Newton, Einstein, and Hawking etc. Namely, we try to touch on just about every different view to puzzles of quantum cosmology, missing mass and the cosmological constant. by the end of the course, students should have a good understanding of: (1) the human desire and need for understanding; (2) the interplay between observations, modeling and theory development, and the need for revisions based on further observations; (3) the role of developing technology in advancing knowledge; (4) the evolution of our views of the universe and our relation to it; and (5) where we are today in our quest. Students are required to write two term papers and present them to the class. The final exam is a open discussion on our views of what we have learned.
Author
Universe; Students; Research

19990103591 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Second-Parameter Effect in Metal-Rich Globular Clusters
Sweigart, Allen V., NASA Goddard Space Flight Center, USA; 1999; 1p; In English; Spectrophotometric Dating of Stars, Apr. 1999, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recent Hubble Space Telescope (HST) observations have shown that the metal-rich globular clusters (GCs) NGC 6388 and NGC 6441 exhibit a pronounced 2nd parameter effect. Ordinarily metal-rich GCs have only a red horizontal-branch (HB) clump. However, NGC 6388 and NGC 6441 also possess an unexpected population of blue HB stars, indicating that some 2nd parameter is operating in these clusters. Quite remarkably, the HBs in both clusters slope upward with decreasing B -V from the red clump

to the top of the blue tail. We review the results of ongoing stellar evolution calculations which indicate (1) that NGC 6388 and NGC 6441 might provide a crucial diagnostic for understanding the origin of the 2nd parameter effect, (2) that differences in age or mass loss along the red-giant branch (RGB) - the two most prominent 2nd parameter candidates - cannot explain the HB morphology of these GCs, and (3) that noncanonical effects involving an enhanced helium abundance or rotation can produce upward sloping HBs. Finally we suggest a new metal-depletion scenario which might help to resolve a baffling conundrum concerning the surface gravities of the blue HB stars in these clusters.

Author

Blue Stars; Horizontal Branch Stars; Metallic Stars; Stellar Evolution; Metallicity; Globular Clusters

19990103602 NASA Goddard Space Flight Center, Greenbelt, MD USA

Likelihood Analysis for Mega Pixel Maps

Kogut, Alan J., NASA Goddard Space Flight Center, USA; Jun. 17, 1999; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The derivation of cosmological parameters from astrophysical data sets routinely involves operations counts which scale as $O(N(\exp 3))$ where N is the number of data points. Currently planned missions, including MAP and Planck, will generate sky maps with $N(\text{sub d}) = 10(\exp 6)$ or more pixels. Simple "brute force" analysis, applied to such mega-pixel data, would require years of computing even on the fastest computers. We describe an algorithm which allows estimation of the likelihood function in the direct pixel basis. The algorithm uses a conjugate gradient approach to evaluate X2 and a geometric approximation to evaluate the determinant. Monte Carlo simulations provide a correction to the determinant, yielding an unbiased estimate of the likelihood surface in an arbitrary region surrounding the likelihood peak. The algorithm requires $O(N(\text{sub d})(\exp 3/2))$ operations and $O(Nd)$ storage for each likelihood evaluation, and allows for significant parallel computation.

Author

Algorithms; Conjugate Gradient Method; Pixels; Maps; Computer Aided Mapping; Astrophysics

19990105721 Johns Hopkins Univ., Applied Physics Lab., Laurel, MD USA

Magnetospheric Morphology and Dynamics: Specification of the Near-Earth Operational Environment *Final Report, 1 Feb. 1996 - 28 Feb. 1999*

Meng, Ching I.; Jul. 13, 1999; 13p; In English

Contract(s)/Grant(s): F49620-96-1-0009; AF Proj. 2311

Report No.(s): AD-A367431; AFRL-SR-BL-TR-99-0207; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Under the aegis of Air Force Office of Scientific Research (AFOSR) funding we conducted original research, for example establishing that intense aurora are suppressed by sunlight and that the solar cycle effect on intense aurora is far different than commonly supposed. Applied research has been an increasing focus, however. Recently our AFOSR research has been driven by an effort to characterize the magnetosphere as accurately as possible i.e., to find and develop the most physically significant state variables using data available from the DMSP series satellites. These include a more sophisticated estimate of the open flux in the polar cap (the energy available for explosive release) and a proven technique for determining the first significantly stretched field line (equivalent to the Earthward edge of the current sheet) from DMSP particle precipitation data.

DTIC

Sunlight; Morphology; Research; Solar Cycles; Auroras; Earth Magnetosphere

91
LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see 18 Spacecraft Design, Testing and Performance.

19990100613 Los Alamos National Lab., NM USA

Design of a nuclear-powered rover for lunar or Martian exploration

Trellue, H. R.; Trautner, R.; Houts, M. G.; Poston, D. I.; Giovig, K.; Aug. 31, 1998; 10p; In English

Report No.(s): DE99-002546; LA-UR-98-3972; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

To perform more advanced studies on the surface of the moon or Mars, a rover must provide long-term power ($(\text{ge})10$ kW(sub e)). However, a majority of rovers in the past have been designed for much lower power levels (i.e., on the order of watts) or for shorter operating periods using stored power. Thus, more advanced systems are required to generate additional power. One possible design for a more highly powered rover involves using a nuclear reactor to supply energy to the rover and material from the

surface of the moon or Mars to shield the electronics from high neutron fluxes and gamma doses. Typically, one of the main disadvantages of using a nuclear-powered rover is that the required shielding would be heavy and expensive to include as part of the payload on a mission. Obtaining most of the required shielding material from the surface of the moon or Mars would reduce the cost of the mission and still provide the necessary power. This paper describes the basic design of a rover that uses the Heat-pipe Power System (HPS) as an energy source, including the shielding and reactor control issues associated with the design. It also discusses briefly the amount of power that can be produced by other power methods (solar/photovoltaic cells, radioisotope power supplies, dynamic radioisotope power systems, and the production of methane or acetylene fuel from the surface of Mars) as a comparison to the HPS.

NTIS

Lunar Exploration; Mars Exploration; Mars (Planet); Mars Surface; Moon; Roving Vehicles; Space Power Reactors; Space Station Power Supplies; Spacecraft Power Supplies

19990101871 Michigan Univ., Dept. of Atmospheric, Oceanic, and Space Science, Ann Arbor, MI USA
Global Observation of Planetary-Scale Waves in UARS HRDI and WINDII MLT Winds *Final Report, 15 Aug. 1998 - 14 Sep. 1999*
Lieberman, Ruth, Michigan Univ., USA; Oct. 01, 1999; 5p; In English
Contract(s)/Grant(s): NAG5-6083; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The purpose of this study is to use examine planetary-scale motions in the UARS mesosphere and lower thermospheric data. The actual study was confined to HRDI winds and temperatures, since these observations were more continuous, and spanned the 60-120 km range. Three classes of waves were studied: fast equatorial Kelvin waves, nonmigrating tides, and the midlatitude 2-day wave. The purpose of the Kelvin wave and the 2-day wave studies was to test whether the waves significantly affect the mean flow. Such studies require high-quality spectral definitions in order to derive the wave heat and momentum flux divergence which can act in comination to drive the mean flow. Accordingly, HRDI winds from several special observing campaigns were used for analyses of fast (periods under 5 days) waves. The campaigns are characterized by continuous viewing by HRDI in 2 viewing directions, for periods of 10-12 days. Data sampled in this manner lend themselves quite well to "asynoptic spectral analysis", from which motions with periods as low as one day can be retrieved with relatively minimal aliasing.

Author

Kelvin Waves; Planetary Waves; Solar Orbits; Planetary Evolution; Data Acquisition

19990102424 NASA Goddard Space Flight Center, Greenbelt, MD USA
The Lunar Prospector Mission: Final Results of Trajectory Design, Quasi-Frozen Orbits, Extended Mission Targeting, and Lunar Topography and Potential Models
Folta, David, NASA Goddard Space Flight Center, USA; Beckman, Mark, NASA Goddard Space Flight Center, USA; Lozier, David, NASA Ames Research Center, USA; Galal, Ken, NASA Ames Research Center, USA; 1999; 2p; In English; Astrodynamics Specialist, Aug. 1999, Girdwood, AK, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

The National Aeronautics and Space Administration (NASA) selected Lunar Prospector (LP) as one of the discovery missions to conduct solar system exploration science investigations. The mission was NASA's first lunar voyage to investigate key science objectives since Apollo and was launched in January 1998. In keeping with discovery program requirements to reduce total mission cost and utilize new technology, Lunar Prospector's mission design and control will focus on the use of innovative and proven trajectory analysis programs. As part of this effort, the Goddard Space Flight Center and the Ames Research Center became partners in the Lunar Prospector trajectory team to provide the trajectory analysis and orbit determination support. At the end of 1998, Lunar Prospector completed its one-year primary mission at 100-km altitude above the lunar surface. On December 19, 1998, Lunar Prospector entered its extended mission phase. The mission orbit was lowered from 100 km to a mean altitude of 40 km. Due to lunar potential effects, the altitude of Lunar Prospector varied from 25 to 55 km above the mean lunar geoid. After one month at 40 km, the lunar potential model was updated based upon the new tracking data at 40 km. On January 15, 1999, the altitude was lowered again to a mean altitude of 30 km. The spherical altitude varied between 15 km and 45 km above the mean lunar geoid while the topographical altitude varied between 10 km and 50 km. Various means were employed to get accurate lunar surface elevation including Clementine altimetry and LOS analysis. Based upon the best available terrain maps, Lunar Prospector reached actual altitudes of 8 km above lunar mountains in the southern polar region. This extended mission phase of six months will enable LP to obtain science data up to 3 orders of magnitude better than at the mission orbit. At the end of the operations mission, LP was targeted for impact at a chosen location that allowed optical observation of the lunar ejecta as LP ended its mission at 1.6 km/sec. This paper details the trajectory design and orbit determination planning and actual results of the Lunar Prospector nominal and extended mission including maneuver design, eccentricity vs. argument of perigee evolution, topographical altitude

estimation, and lunar potential modeling. This paper provides understanding of the quasi-frozen orbit design of the LP mission, the optimization process of lunar orbit targets, the impacts that the selected lunar potential models play, and discusses the feasibility of meeting the mission goals. Observed evolution of the Keplerian orbit elements are compared to the theoretical predictions using the latest lunar potential model available which incorporates the Lunar Prospector Doppler data. Mapping orbit maintenance maneuver design along with results of the actual maneuvers to maintain the orbital requirements are also presented.
Author

Lunar Orbits; Lunar Prospector; Mission Planning; Orbit Calculation; Trajectories; Trajectory Analysis; Lunar Gravitational Effects; Lunar Programs; Lunar Exploration

19990102924 NASA Goddard Space Flight Center, Greenbelt, MD USA
Hematite Versus Magnetite as the Signature for Planetary Magnetic Anomalies?
Kletetshka, Gunther, NASA Goddard Space Flight Center, USA; Taylor, Patrick T., NASA Goddard Space Flight Center, USA; Wasilewski, Peter J., NASA Goddard Space Flight Center, USA; 1999; 22p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Crustal magnetic anomalies are the result of adjacent geologic units having contrasting magnetization. This magnetization arises from induction and/or remanence. In a planetary context we now know that Mars has significant crustal magnetic anomalies due to remanent magnetization, while the Earth has some anomalies where remanence can be shown to be important. This picture, however, is less clear because of the nature and the magnitude of the geomagnetic field which is responsible for superimposed induced magnetization. Induced magnetization assumes a magnetite source, because of its much greater magnetic susceptibility when compared with other magnetic minerals. We investigated the TRM (thermoremanent magnetization) acquisition of hematite, in weak magnetic fields up to 1 mT, to determine if the remanent and induced magnetization of hematite could compete with magnetite. TRM acquisition curves of magnetite and hematite show that multi-domain hematite reaches TRM saturation (0.3 - 0.4 A sq m/kg) in fields as low as 100 microT. However, multi-domain magnetite reaches only a few percent of its TRM saturation in a field of 100 microT (0.02 - 0.06 A sq m/kg). These results suggest that a mineral such as hematite and, perhaps, other minerals with significant remanence and minor induced magnetization may play an important role in providing requisite magnetization contrast. Perhaps, and especially for the Mars case, we should reevaluate where hematite and other minerals, with efficient remanence acquisition, exist in significant concentration, allowing a more comprehensive explanation of Martian anomalies and better insight into the role of remanent magnetization in terrestrial crustal magnetic anomalies.
Author

Hematite; Magnetite; Magnetization; Planetary Magnetic Fields; Geomagnetism; Remanence

19990103078 NASA Goddard Space Flight Center, Greenbelt, MD USA
Detection of C2H4 Neptune from ISO/PHT-S Observations
Schulz, B., European Space Agency, Spain; Encrenaz, Th., Observatoire de Paris-Meudon, France; Bezard, B., Observatoire de Paris-Meudon, France; Romani, P. N., NASA Goddard Space Flight Center, USA; Lellouch, E., Observatoire de Paris-Meudon, France; Atreya, S. K., Michigan Univ., USA; Journal of Astrophysical and Astrophysics Letters; Sep. 01, 1999; 5p; In English; Sponsored in part from ESA in the Netherlands and the UK; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The 6-12 micrometer spectrum of Neptune has been recorded with the PHT-S instrument of the Infrared Space Observatory (ISO) at a resolution of 0.095 micrometer. In addition to the emissions of CH4, CH3D and C2H6 previously identified, the spectrum shows the first firm identification of ethylene C2H4. The inferred column density above the 0.2-mbar level is in the range (1.1 - 3) x 10(exp 14) molecules/cm. to produce this low amount, previous photochemical models invoked rapid mixing between the source and sink regions of C2H4. We show that this requirement can be relaxed if recent laboratory measurements of CH4 photolysis branching ratios at Lyman alpha are used.
Author

Ethylene; Neptune (Planet); Spectra; Radiation Transport; Radiative Transfer; Photolysis; Photochemical Reactions

19990103596 NASA Goddard Space Flight Center, Greenbelt, MD USA
Jovian Northern Ethane Aurora and the Solar Cycle
Kostiuk,T., NASA Goddard Space Flight Center, USA; Livengood, T., Maryland Univ., USA; Fast, K., Maryland Univ., USA; Buhl, D., NASA Goddard Space Flight Center, USA; Goldstein, J., Challenger Center, USA; Hewagama, T., Challenger Center, USA; 1999; 1p; In English; Magnetospheres of the Outer Planets, 9-14 Aug. 1999, Paris, France; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Thermal infrared auroral spectra from Jupiter's North polar region have been collected from 1979 to 1998 in a continuing study of long-term variability in the northern thermal IR aurora, using C2H6 emission lines near 12 microns as a probe. Data from

Voyager I and 2 IRIS measurements and ground based spectral measurements were analyzed using the same model atmosphere to provide a consistent relative comparison. A retrieved equivalent mole fraction was used to compare the observed integrated emission. Short term (days), medium term (months) and long term (years) variability in the ethane emission was observed. The variability of C2H6 emission intensities was compared to Jupiter's seasonal cycle and the solar activity cycle. A positive correlation appears to exist, with significantly greater emission and short term variability during solar maxima. Observations on 60 N latitude during increased solar activity in 1979, 1989, and most recently in 1998 show up to 5 times brighter integrated line emission of C2H6 near the north polar "hot spot" (150-210 latitude) than from the north quiescent region. Significantly lower enhancement was observed during periods of lower solar activity in 1982, 1983, 1993, and 1995. Possible sources and mechanisms for the enhancement and variability will be discussed.

Author

Ethane; Jupiter (Planet); Solar Activity; Solar Cycles; Auroras; Infrared Astronomy; Auroral Zones

19990103603 NASA Goddard Space Flight Center, Greenbelt, MD USA

Wind Enhanced Escape, Ion Pickup and the Evolution of Water on Mars

Hartle, Richard, NASA Goddard Space Flight Center, USA; 1999; 1p; In English, 18-30 Jul. 1999, Birmingham, UK; Sponsored by International Council of Scientific Unions; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Preferential loss of hydrogen over deuterium from Mars has produced a deuterium rich atmosphere possessing a D/B ratio 5.2 times that of terrestrial water. Rayleigh fractionation is applied, constrained by the deuterium enrichment factor, to determine the magnitudes of ancient and present water reservoirs on the planet. The dominant lose mechanisms of R and D from the current atmosphere are thought to be thermal escape and solar wind ion pickup of the neutral and ion forms of theme constituents, respectively. During an earlier martian epoch, only thermal escape was significant because Mars had a terrestrial sized magnetosphere that protected the atmosphere from solar wind scavenging processes. The magnitudes of present and ancient water reservoirs are estimated when thermal escape is considered alone and subsequently when the effects of ion pickup are added. The escape fluxes of R and D are significantly increased above the respective Jeans fluxes when the effects of thermospheric winds and planetary rotation are accounted for at the exobase. Such wind enhanced escape also increases as the mass of an escaping constituent increases; thus, the increase in the escape flux of D is greater than that of H. When the fractionation process is also constrained by the D/H ratio observed in hydrous minerals of SNC meteorites, an ancient crustal reservoir of Martian water in derived, tens of meters in global-equivalent depth, considerably exceeding that obtained with no winds. The reservoir becomes even larger when ion pickup processes are added.

Author

Deuterium; Hydrogen; Mars (Planet); Solar Wind; Water; Losses; Atmospheric Composition; Mars Atmosphere

19990104321 Iowa State Univ. of Science and Technology, Agricultural Meteorology, Ames, IA USA

On the Potential Impact of Daytime Surface Sensible Heat Flux on the Dissipation of Martian Cold Air Outbreaks

Segal, M., Iowa State Univ. of Science and Technology, USA; Arritt, R. W., Iowa State Univ. of Science and Technology, USA; Tillman, J. E., Washington Univ., USA; Journal of the Atmospheric Sciences; Jan. 01, 1997; Volume 54, pp. 1544-1549; In English Contract(s)/Grant(s): NAGw-4060; NAGw-3381; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

The Martian daytime soil surface temperature is governed primarily by the net irradiance balance and surface soil heat flux. Thus the outbreak of a cold air mass generates increased sensible heat flux that is conducive to daytime dissipation of the cold air mass thermal characteristics. Conceptual and scaling evaluations of this dissipation are provided while comparison is made with similar situations on Earth. It is estimated that sensible heat flux contribution to the dissipation of the original thermal structure of the cold air could be three times larger than the corresponding situation on Earth. Illustrative numerical model simulations provide scaling of the potential impact on the dissipation of cold air masses for various combinations of background wind speed and latitudes.

Author

Heat Flux; Mars Atmosphere; Mars Surface; Mathematical Models; Temperature Distribution; Land Surface Temperature; Daytime; Cold Weather; Planetary Meteorology

19990104339 NASA Marshall Space Flight Center, Huntsville, AL USA

In situ Resource Utilization for Processing of Metal Alloys on Lunar and Mars Bases

Stefanescu, D. M., Alabama Univ., USA; Grugel, R. N., Universities Space Research Association, USA; Curreri, P. A., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Proceedings of American Society of Civil Engineers Conference, 26-30 Apr. 1998, Albuquerque, NM, USA; No Copyright; Avail: Issuing Activity (NASA, Marshall Space Flight Center, Huntsville, AL); Abstract Only, Hardcopy, Microfiche

Current plans for practical missions leading to a sustained human presence on our Moon and Mars rely on utilizing their in situ resources. Initially, resource availability must be assessed followed by the development of economically acceptable and technically feasible extractive processes. In regard to metals processing and fabrication, the lower gravity level on the Moon (0.125 g) and Mars (0.369 g) will dramatically change the presently accepted hierarchy of materials in terms of specific properties, a factor which must be understood and exploited. Furthermore, significant changes are expected in the behavior of liquid metals during processing. In metal casting, for example, mold filling and associated solidification processes have to be reevaluated. Finally, microstructural development and therefore material properties, presently being documented through ongoing research in microgravity science and applications, needs to be understood and scaled to the reduced gravity environments. These and other issues are addressed in this paper.

Author

Alloys; Microgravity; Liquid Metals; Lunar Bases; Mars Bases

19990104361 NASA Marshall Space Flight Center, Huntsville, AL USA

Radiation Effects and Protection for Moon and Mars Missions

Parnell, Thomas A., NASA Marshall Space Flight Center, USA; Watts, John W., Jr., NASA Marshall Space Flight Center, USA; Armstrong, Tony W., Science Applications International Corp., USA; 1998; 1p; In English, 26-30 Apr. 1998, Albuquerque, NM, USA; Sponsored by American Society of Civil Engineers; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Manned and robotic missions to the Earth's moon and Mars are exposed to a continuous flux of Galactic Cosmic Rays (GCR) and occasional, but intense, fluxes of Solar Energetic Particles (SEP). These natural radiations impose hazards to manned exploration, but also present some constraints to the design of robotic missions. The hazards to interplanetary flight crews and their uncertainties have been studied recently by a National Research Council Committee (Space Studies Board 1996). Considering the present uncertainty estimates, thick spacecraft shielding would be needed for manned missions, some of which could be accomplished with onboard equipment and expendables. For manned and robotic missions, the effects of radiation on electronics, sensors, and controls require special consideration in spacecraft design. This paper describes the GCR and SEP particle fluxes, secondary particles behind shielding, uncertainties in radiobiological effects and their impact on manned spacecraft design, as well as the major effects on spacecraft equipment. The principal calculational tools and considerations to mitigate the radiation effects are discussed, and work in progress to reduce uncertainties is included.

Author

Energetic Particles; Galactic Cosmic Rays; Interplanetary Flight; Manned Spacecraft; Protection; Radiation Effects; Spacecraft Shielding; Solar Radiation Shielding

19990104367 NASA Marshall Space Flight Center, Huntsville, AL USA

High Performance Materials Applications to Moon/Mars Missions and Bases

Noever, David A., NASA Marshall Space Flight Center, USA; Smith, David D., NASA Marshall Space Flight Center, USA; Sibille, Laurent, Universities Space Research Association, USA; Brown, Scott C., Southern Research Inst., USA; Cronise, Raymond J., NASA Marshall Space Flight Center, USA; Lehoczky, Sandor L., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; 6th; Engineering Construction and Operations in Space, 26-30 Apr. 1998, Albuquerque, NM, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Two classes of material processing scenarios will feature prominently in future interplanetary exploration- in situ production using locally available materials in lunar or planetary landings and high performance structural materials which carve out a set of properties for uniquely hostile space environments. to be competitive, high performance materials must typically offer orders of magnitude improvements in thermal conductivity or insulation, deliver high strength-to-weight ratios, or provide superior durability (low corrosion and/or ablative character, e.g. in heat shields). The space-related environmental parameters of high radiation flux, low weight and superior reliability limits many typical aerospace materials to a short list comprising high performance alloys, nanocomposites and thin-layer metal laminates (Al-Cu, Al-Ag) with typical dimensions less than the Frank-Reed-type dislocation source. Extremely light weight carbon-carbon composites and car on aerogels will be presented as novel examples which define broadened material parameters, particularly owing to their extreme thermal insulation (R-32-64) and low densities (less than 0.01 g/cc) approaching that of air itself. Even with these low weight payload additions, rocket thrust limits and transport costs will always place a premium on assembling as much structural and life support resources upon interplanetary, lunar or asteroid arrival. As an example for in situ lunar glass manufacture, solar furnaces reaching 1700 C for pure silica glass manufacture in situ are compared with sol-gel technology and acid-leached ultrapure (less than 0.1% FeO) silica aerogel precursors.

Author

Aircraft Construction Materials; Thermal Conductivity; Thermal Insulation; Manufacturing; Lunar Landing; High Strength; Durability; Carbon-Carbon Composites; Copper Alloys; Construction Materials

19990105634 Arizona State Univ., Dept. of Geology, Tempe, AZ USA

Geologic Studies in Support of Manned Martian Exploration

Frix, Perry, Arizona State Univ., USA; McCloskey, Katherine, Arizona State Univ., USA; Neakrase, Lynn D. V., Arizona State Univ., USA; Greeley, Ronald, Arizona State Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 17-33; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

With the advent of the space exploration of the middle part of this century, Mars has become a tangible target for manned space flight missions in the upcoming decades. The goals of Mars exploration focus mainly on the presence of water and the geologic features associated with it. to explore the feasibility of a manned mission, a field analog project was conducted. The project began by examining a series of aerial photographs representing "descent" space craft images. From the photographs, local and regional geology of the two "landing" sites was determined and several "targets of interest" were chosen. The targets were prioritized based on relevance to achieving the goals of the project and Mars exploration. Traverses to each target, as well as measurements and sample collections were planned, and a timeline for the exercise was created. From this it was found that for any mission to be successful, a balance must be discovered between keeping to the planned timeline schedule, and impromptu revision of the mission to allow for conflicts, problems and other adjustments necessary due to greater information gathered upon arrival at the landing site. At the conclusion of the field exercise, it was determined that a valuable resource for mission planning is high resolution remote sensing of the landing area. This led us to conduct a study to determine what ranges of resolution are necessary to observe geology features important to achieving the goals of Mars exploration. The procedure used involved degrading a set of images to differing resolutions, which were then examined to determine what features could be seen and interpreted. The features were rated for recognizability, the results were tabulated, and a minimum necessary resolution was determined. Our study found that for the streams, boulders, bedrock, and volcanic features that we observed, a resolution of at least 1 meter/pixel is necessary. We note though that this resolution depends on the size of the feature being observed, and thus for Mars the resolution may be lower due to the larger size of some features. With this new information, we then examined the highest resolution images taken to date by the Mars Orbital Camera on board the Mars Global Surveyor, and planned a manned mission. We chose our site keeping in mind the goals for Mars exploration, then determined the local and regional geolog of the "landing area. Prioritization was then done on the geologic features seen and traverses were planned to various "targets of interest". A schedule for each traverse stop, including what measurements and samples were to br taken, and a timeline for the mission was then created with ample time allowed for revisions of plans, new discoveries, and possible complications.

Author

Geology; Mars Exploration; Mars Global Surveyor; Mission Planning; Remote Sensing

19990105637 Georgia State Univ., Atlanta, GA USA

Mars Scenario-Based Visioning: Logistical Optimization of Transportation Architectures

Second Annual HEDS-UP Forum; 1999, pp. 77-96; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

The purpose of this conceptual design investigation is to examine transportation forecasts for future human Wu missions to Mars. - Scenario-Based Visioning is used to generate possible future demand projections. These scenarios are then coupled with availability, cost, and capacity parameters for indigenously designed Mars Transfer Vehicles (solar electric, nuclear thermal, and chemical propulsion types) and Earth-to-Orbit launch vehicles (current, future, and indigenous) to provide a cost-conscious dual-phase launch manifest to meet such future demand. A simulator named M-SAT (Mars Scenario Analysis Tool) is developed using this method. This simulation is used to examine three specific transportation scenarios to Mars: a limited "flaus and footprints" mission, a More ambitious scientific expedition similar to an expanded version of the Design Reference Mission from NASA, and a long-term colonization scenario. Initial results from the simulation indicate that chemical propulsion systems might be the architecture of choice for all three scenarios. With this mind, "what if' analyses were performed which indicated that if nuclear production costs were reduced by 30% for the colonization scenario, then the nuclear architecture would have a lower life cycle cost than the chemical. Results indicate that the most cost-effective solution to the Mars transportation problem is to plan for segmented development, this involves development of one vehicle at one opportunity and derivatives of that vehicle at subsequent opportunities.

Author

Design Analysis; Transportation; Cost Effectiveness; Simulators; Propulsion System Configurations; Production Costs; Launch Vehicles; Forecasting

19990105638 Metropolitan State Coll., Denver, CO USA

MADEX: Martian Drilling and Exploration

Second Annual HEDS-UP Forum; 1999, pp. 97-112; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hard-

copy

The concept will take samples and spectrometer data at various depths below the Martian surface. The unit will address three major objectives for the human exploration of Mars. 1) Can humans ultimately inhabit Mars? 2) Is there or has there been life on Mars? and 3) What is the history of the Martian planet? Rather than drilling vertically from the surface of the planet an taking samples at predetermined depths, the Martian Drilling and Exploration Unit (MADEX), will be lowered over a cliff to drill horizontally at various depths. The unit will attempt to satisfy the objectives using spectroscopic data taken along the cliff wall and analysis of the core samples taken.

Author

Mars Surface; Planetary Surfaces; Drilling; Core Sampling

19990105639 California Univ., Berkeley, CA USA

Interactive Design Environment: Tools for Facilitating Communication and Collaboration Among Universities on Projects Related to a Mars Mission

Second Annual HEDS-UP Forum; 1999, pp. 113-130; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

The HEDS-UP program is comprised of student groups from many different universities across the USA working independently on various aspects of the grand objective - a manned mission to Mars. The inherent value of the program is in the nature of the students working in it. Students offer a different perspective on an existing project. Their contribution is in bringing the off the wall ideas to the table, among others. Students are unbounded by tradition and precedents in methodology. This enables them to approach the problem from a unique angle. They have the potential to bring fresh ideas and new dimensions to the overall project, thus contributing something original rather than mimicking existing projects. With proper facilitation the HEDS-UP program can become an evolutionary dynamic im environment in which ideas are proposed and tested under pressure and those with sufficient merit survive. Moreover, the incredibly cheap price of student labor gives the HEDS-UP program enormous potential to provide a substantial and lasting contribution to the Mars mission. The potential value of the projects completed by the HEDS-UP universities is limited by the geographical and academic separation of the universities, the short term nature of the projects, and insufficient input from NASA. If communication exists between the universities at all, it is minimal and limited to the conference, The projects are limited by the school term and the turn over rate of the participants is exceedingly high with an influx of new students each semester. This means that much of the work from previous semesters is lost as it is improperly passed on, incompletely understood, and consequently disregarded. There is no consistent method employed across the universities for storing the information and making it accessible to others in the field. Moreover the projects suffer from a dislocation from NASA itself. The insufficient feedback and inadequate resources for the projects limit their technical content. If a means of overcoming these limiting factors is found, the Mars mission project could then fully take advantage of the enormous pool of talent that currently exists within the HEDS-UP program.

Derived from text

Manned Mars Missions; Schools; Students; Universities; Management Planning

19990105641 Maryland Univ., College Park, MD USA

MARV: Martian Airborne Research Vehicle

Second Annual HEDS-UP Forum; 1999, pp. 147-164; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

Current Mars reference missions specify mission lengths that exceed present day limits on long-duration FM space flight. An increase in the length of on-site times over previous manned missions allows for greater scientific and exploratory flexibility. With this flexibility comes new opportunities for increasing our understanding of the solar system in which we live. to take advantage of these opportunities requires the development of new long-range transportation systems. Such systems must be able to operate in adverse environments with minimal investment in infrastructure while providing a high scientific return on investment. An aerial research vehicle provides a great deal of mobility in selecting specific sites to explore. Recent developments in the space community have recognized the need to explore beyond the limited scope offered by a stationary base camp or even a land rover. An airborne research vehicle provides the mobility to explore areas of interest that lie at great distances from the base site. Long distance missions requires the crew to w have a great deal of discretion in selecting destinations based on information not available before the mission. Airships have the flexibility to travel to sites without prior knowledge of the site's conditions. The selection of an airship as the primary mode of transportation maximizes the crew's ability to act on "local decisions" which in turn increase the mission's scientific return.

Author

Manned Space Flight; Mars Missions; Research Vehicles; Solar System

19990105642 Maryland Univ., College Park, MD USA

An Astronaut Assistant Rover for Martian Surface Exploration

Second Annual HEDS-UP Forum; 1999, pp. 165-180; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

Lunar exploration, recent field tests, and even on-orbit operations suggest the need for a robotic assistant for an astronaut during extravehicular activity (EVA) tasks. The focus of this paper is the design of a 300-kg, 2 cubic meter, semi-autonomous robotic rover to assist astronauts during Mars surface exploration. General uses of this rover include remote teleoperated control, local EVA astronaut control, and autonomous control. Rover size, speed, sample capacity, scientific payload and dexterous fidelity were based on known Martian environmental parameters,- established National Aeronautics and Space Administration (NASA) standards, the NASA Mars Exploration Reference Mission, and lessons learned from lunar and on-orbit sorties. An assumed protocol of a geological, two astronaut EVA performed during daylight hours with a maximum duration of tour hour dictated the following design requirements: (1) autonomously follow the EVA team over astronaut traversable Martian terrain for four hours; (2) retrieve, catalog, and carry 12 kg of samples; (3) carry tools and minimal in-field scientific equipment; (4) provide contingency life support; (5) compile and store a detailed map of surrounding terrain and estimate current position with respect to base camp; (6) provide supplemental communications systems; and (7) carry and support the use of a 7 degree - of- freedom dexterous manipulator.

Author

Automatic Control; Remote Control; Robotics; Teleoperators; Design Analysis; Manipulators; Mars Exploration; Planetary Geology

19990105643 University of Southern California, Dept. of Aerospace Engineering, Los Angeles, CA USA

The Exploration of Mars: Crew Surface Activities

Second Annual HEDS-UP Forum; 1999, pp. 181-199; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

Surface activities of the first Mars mission crew, as suggested in phase 1 of the NASA HEDS reference mission, are discussed in this paper. The HEDS reference mission calls for a two phased approach. In phase 1, humans supported by robotic systems will explore the Martian surface, collect and analyze geologic, geophysical, and meteorological data, search for potential permanent base sites, and conduct technology verification experiments. In phase 2, a Mars base site will be selected, and the building of a permanent human base will be initiated. In this report two complementary architectures are portrayed. First, a permanent base for 3-6 people consisting of an ISRU unit, two nuclear power systems, a green house, and inflatable habitats and laboratories, built inside adobe structures. Second, a reusable, and resupplyable methane propelled very long range type traverse vehicle capable of collecting and analyzing data, and repairing and deploying scientific payloads during its planned 150 days 4800 km traverse. The very long range traverse vehicle will carry smaller rovers, crawlers, blimps, and an air drill capable of quickly reaching depths beyond 100m. The report presents a global vision of human activities on the surface of Mars at a programmatic level. It consists of several vignettes called "concept architectures". We speculate that these activities will facilitate a phase 1 Mars exploration architecture.

Author

Robotics; Payloads; Mars Missions; Mars Exploration; Maintenance

19990105644 Texas Univ., Austin, TX USA

Conceptual Design of a Mars Surface Transportation System (MSTS)

Collins, Chad, Texas Univ., USA; Gomez, Alex, Texas Univ., USA; Muniz, Rick, Texas Univ., USA; Musson, Dave, Texas Univ., USA; Second Annual HEDS-UP Forum; 1999, pp. 201-225; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

We have proposed a design for a Mars Surface Transportation System. The design will support multi-range and multi-purpose scientific/exploratory activities for extended periods. Several assumptions were made before developing a desiun: 1. This system is to be deployed early in a series of piloted landings on the planet surface. 2. A Mars surface base has already been established. 3. A transport system to and from Mars already exists. 4. The capacity to transport this proposed system exists within the current transport design. 5. Facilities exist at this base for the supply of fuel and other consumables. 6. Medical facilities are a component of the main base. 7. The surface conditions of Mars are known and are.accurate. It was decided that the transportation system design should support a crew of two for up to four weeks away from the primary base. In order to support multiple mission requirements, the system is modular and m multi-configurable, The main structural aspects of the design are: 1. An inflatable habitat module. 2. Independently powered and remotely controllable wheel trucks to allow multiple configurations and ease of system assembly. 3. Parabolic space trusses for hi-h structural stability with low overall system mass. In addition to these design aspects,

new and existing concepts for control systems, power, radiation protection, and crew safety have been incorporated into the transportation system design.
Author

Design Analysis; Structural Stability; Surface Vehicles; Mars Environment; Mars Surface; Systems Engineering

19990105646 Wichita State Univ., Wichita, KS USA

Marvin: MARtian Vehicular INvestigator A Proposal for a Long-Range Pressurized Rover

Second Annual HEDS-UP Forum; 1999, pp. 247-264; In English; See also 19990105633; Copyright; Avail: Issuing Activity, Hardcopy

    NASA is planning manned missions to Mars in the near future. In order to fully exploit the available time on the surface for exploration, a roving vehicle is necessary. A nine-member student design team from the Wichita State University Department of Aerospace Engineering developed the MARtian Vehicular INvestigator (MARVIN) a manned, pressurized, long distance rover. In order to meet the unique requirements for successful operation in the harsh Martian environment a four wheeled, rover was designed with a composite pressure vessel six meters long and 2.5 meters in diameter. The rover is powered by twin proton exchange membrane fuel cells which provide electricity to the drive motors and onboard systems. The MARVIN concept is expected to have a 1500 km range with a maximum speed of 25 km/hr and a 14-day endurance.
Author

Manned Space Flight; Mars Environment; Mars Missions; Roving Vehicles; Design Analysis

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SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots. For related information see 93 Space Radiation.

19990099699 NASA Marshall Space Flight Center, Huntsville, AL USA

On Photospheric Fluorescence and the Nature of the 17.62 Angstrom Feature in Solar X-ray Spectra

Drake, Jeremy J., NASA Marshall Space Flight Center, USA; Swartz, Douglas A., NASA Marshall Space Flight Center, USA; Beiersdorfer, Peter, NASA Marshall Space Flight Center, USA; Brown, Greg, NASA Marshall Space Flight Center, USA; Kahn, S., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

    The identification of the emission line feature at 17.62 Angstroms in solar x-ray spectra is re-examined. Using a Monte Carlo technique, we compute a realistic theoretical upper limit to the observed Fe L-alpha photospheric fluorescent line strength caused by irradiation from an overlying corona. These calculations demonstrate that the photospheric Fe L-alpha characteristic line is much too weak to account for the observed 17.62 Angstrom line flux. Instead, we identify this line with the configuration interaction 2s2p3p2P-2s2p6 2S transition in Fe XVIII seen in Electron Beam Ion Trap spectra and predicted in earlier theoretical work on the Fe XVIII x-ray spectrum.
Author

Photosphere; Fluorescence; Solar X-Rays; X Ray Spectra

19990099701 NASA Marshall Space Flight Center, Huntsville, AL USA

Observation and Modeling of the Solar Transition Region, 1, A Quasi-Static Loops Model with Implications for Heating the Lower Transition Region

Oluseyi, Hakeem M., Stanford Univ., USA; Walker, A. B. C., II, Stanford Univ., USA; Porter, Jason, NASA Marshall Space Flight Center, USA; Hoover, Richard B., NASA Marshall Space Flight Center, USA; Barbee, Troy W., Jr., Lawrence Livermore National Lab., USA; 1998; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

    We report on observations of the solar atmosphere in several extreme ultraviolet and far-ultraviolet bandpasses obtained by the Multi-Spectral Solar Telescope Array, a rocket borne spectroheliograph, on flights in 1987, 1991, and 1994, spanning the last solar maximum. Quiet sun emission observed in the 171 A - 175 A bandpass, which includes lines of 0Ov, O vi, Fe ix, and Fe x, has been analyzed to test models of the temperatures and geometries of the structures responsible for this emission. Analyses of intensity variations above the solar limb reveal scale heights consistent with a quiet sun plasma temperature of 500 000 K less than or equal to T(sub e) less than or equal to 800 000 K. Intensity modulations in the quiet sun are observed to occur on a scale comparable to the supergranular scale. The structures responsible for the quiet sun EUV emission are modeled as small quasi-static loops. We find that the emission predicted by loop models with maximum temperatures between 700 000 K and 900 000 K are consistent with our observations. We also present a preliminary comparison of the predictions of our models with observations

of diagnostic spectral line ratios obtained from previous observers. We discuss the implications a distribution of loops of the type we model here would have for heating the lower transition region. Finally, in fight of the models we calculate here, we briefly review the current state of knowledge concerning the contributions thermal conduction from coronal (T(sub e) greater than or equal to 10(exp 6) K) and upper transition region (10(exp 5) K less than T(sub e) less than 10(esp 6) K) structures make to lower transition region emission. We argue that the evidence which has lead many authors to conclude that the interface of hotter and cooler plasmas makes a negligible contribution to lower transition region emission is much less compelling in light of recent observations and analyses. We further argue that it is the interface of chromospheric material with structures such as loops that have sub-coronal peak temperatures (i.e. less than 900 000 K) that makes the dominant contribution to lower transition region emission in the quiet sun.

Author

Observation; Models; Solar Atmosphere; Solar Activity Effects; Extreme Ultraviolet Radiation

19990100636 Miami Univ., Physics Dept., Coral Gables, FL USA

A New Instrument for Measurement of the Solar Aureole Radiance Distribution from Unstable Platforms

Ritter, Joseph M., Miami Univ., USA; Voss, Kenneth J., Miami Univ., USA; 1999; 19p; In English

Contract(s)/Grant(s): NAS5-31363; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A novel imaging solar aureole radiometer, which can obtain absolute radiometric measurements of the solar aureole when operated on an unstable platform is described. A CCD array is used to image the aureole, while a neutral density occulter on a long pole blocks the direct solar radiation. This ensures accurate direction registration as the sun appears in acquired images, and the total circumsolar region is measured simultaneously. The imaging nature of this instrument along with a special triggering device permit acquisition of the circumsolar sky radiance within 7.5 degrees of the center of the solar disk, and within 1 degree of the edge of the solar disk. This innovation makes possible for the first time, reliable and accurate radiometric measurements of the solar aureole from unstable mobile platforms such as ships. This allows determination small angle atmospheric scattering. The instrument has been used in field studies of atmospheric aerosols and will be used in satellite validation and calibration campaigns.

Author

Sun; Circumsolar Radiation; Atmospheric Scattering; Light Scattering; Sunlight; Sky Brightness; Sky Radiation

19990100865 NASA Marshall Space Flight Center, Huntsville, AL USA

Complex H(sub alpha) Loop Activity in a Long Duration Flare

Debi Prasad, Choudhary, NASA Marshall Space Flight Center, USA; Gary, G. Allen, NASA Marshall Space Flight Center, USA; Ambastha, Ashok K., Udaipur Solar Observatory, India; 1998; In English, 20-23 Oct. 1998, Sac Peak, AZ, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A long duration Bare was observed in the active region NOAA 6555 on March 23, 1991 at a location of low magnetic shear. This flare displayed complex H(sub alpha) loop activity during the decay phase. Initially, there were a few long loops orientated at an angle of about 45 degree with the east-west axis followed by the appearance of east-west axis. This configuration was aligned shorter loops. by using different magnetic field models, we have extrapolated the photospheric magnetogram.9 to the chromospheric heights. The magnetic field lines computed by using the potential field model correspond to most of the observed H. loops. In this paper, we report the analysis of high resolution chromospheric observations of the event and describe a possible scenario for the post-flare loop activity.

Author

Potential Fields; Magnetic Fields; Flared Bodies

19990100871 NASA Marshall Space Flight Center, Huntsville, AL USA

Beta in Streamers

Suess, Steven T., NASA Marshall Space Flight Center, USA; Gary G. A., NASA Marshall Space Flight Center, USA; Nerney, S. F., Ohio Univ., USA; 1999; 1p; In English; 9th; Solar Wind, Jan. 1999, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

Streamers are often described as regions of the corona in which the density is higher than in coronal holes because the plasma is trapped by closed loops of magnetic flux. In contrast, Magnetohydrodynamics (MHD) models of the global corona show that the plasma beta identically equal to 8(pi)p/B(exp 2) is greater than 1 in streamers above approximately 1.2Rs heliocentric height (p=pressure, B=magnetic field strength). There are three recent contributions to this topic. The first is that heating near the cusp further drives Beta up and can result in release of new slow solar wind from the top of the streamer. The second is SOHO/UVCS observations, in combination with a potential field/source surface model of the magnetic field, show beta is greater than 1 above

1.2Rs in a streamer observed near solar sunspot minimum. The third is a magnetic field reconstruction technique (using field deforming algorithms) which was applied both to an isolated active region (AR 7999) and to the Pneuman & Kopp global MHD model. In the active region, beta becomes larger than unity at approximately 1.2Rs. In the Pneuman & Kopp model, beta = 1.0 at the base of the streamer and rises with increasing height, becoming 15-20 at 1.6Rs and 35-55 at 1.7RS. The collective implication of these three results is that beta is greater than 1 everywhere in streamers above approximately 1.2 Rs. Global simulations go on to show that the reason streamers do not simply explode under such high beta conditions is that they are held down by pressure from the sides due to the magnetic fields (and low beta) in adjacent coronal holes. The main role of the closed magnetic loops near the cusp is to keep the streamer from continuously leaking plasma, as otherwise happens in a magnetic pinch which is similar but has no closed loops. The purpose of this note is to summarize the results implying that beta is greater than 1 is a general property of streamers above 1.2 Rs.

Author

Beta Factor; Solar Physics; Coronal Holes

19990100872 NASA Marshall Space Flight Center, Huntsville, AL USA

On Heating the Sun's Corona by Magnetic Explosions: Feasibility in Active Regions and prospects for Quiet Regions and Coronal Holes

Moore, Ronald L., NASA Marshall Space Flight Center, USA; Falconer, D. A., NASA Marshall Space Flight Center, USA; Porter, Jason G., NASA Marshall Space Flight Center, USA; Suess, Steven T., NASA Marshall Space Flight Center, USA; January 1999; 1p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

We build a case for the persistent strong coronal heating in active regions and the pervasive quasi-steady heating of the corona in quiet regions and coronal holes being driven in basically the same way as the intense transient heating in solar flares: by explosions of sheared magnetic fields in the cores of initially closed bipoles. We begin by summarizing the observational case for exploding sheared core fields being the drivers of a wide variety of flare events, with and without coronal mass ejections. We conclude that the arrangement of an event's flare heating, whether there is a coronal mass ejection, and the time and place of the ejection relative to the flare heating are all largely determined by four elements of the form and action of the magnetic field: (1) the arrangement of the impacted, interacting bipoles participating in the event, (2) which of these bipoles are active (have sheared core fields that explode) and which are passive (are heated by injection from impacted active bipoles), (3) which core field explodes first, and (4) which core-field explosions are confined within the closed field of their bipoles and which ejectively open their bipoles. We then apply this magnetic-configuration framework for flare heating to the strong coronal heating observed by the Yohkoh Soft X-ray Telescope in an active region with strongly sheared core fields observed by the MSFC vector magnetograph. All of the strong coronal heating is in continually microflaring sheared core fields or in extended loops rooted against the active core fields. Thus, the strong heating occurs in field configurations consistent with the heating being driven by frequent core-field explosions that are smaller but similar to those in confined flares and flaring arches. From analysis of the thermal and magnetic energetics of two selected core-field microflares and a bright extended loop, we find that (1) it is energetically feasible for the sheared core fields to drive all of the coronal heating in the active region via a staccato of magnetic microexplosions, (2) the microflares at the feet of the extended loop behave as the flares at the feet of flaring arches in that more coronal heating is driven within the active bipole than in the extended loop, (3) the filling factor of the X-ray plasma in the core field microflares and in the extended loop is approximately 0.1, and (4) to release enough magnetic energy for a typical microflare ($10^{27} - 10^{28}$ erg), a microflaring strand of sheared core field need expand and/or untwist by only a few percent at most. Finally, we point out that (1) the field configurations for strong coronal heating in our example active region (i.e., neutral-line core fields, many embedded in the feet of extended loops) are present in abundance in the magnetic network in quiet regions and coronal holes, and (2) it is known that many network bipoles do microflare and that many produce detectable coronal heating. We therefore propose that exploding sheared core fields are the drivers of most of the heating and dynamics of the solar atmosphere, ranging from the largest and most powerful coronal mass ejections and flares, to the vigorous microflaring and coronal heating in active regions, to the multitude of fine-scale explosive events in the magnetic network. The low-lysing exploding core fields in the network drive microflares, spicules, global coronal heating, and ,consequently, the solar wind.

Author

Solar Atmosphere; Solar Physics; Sun; Coronal Holes; Feasibility; Solar Heating

19990102208 NASA Marshall Space Flight Center, Huntsville, AL USA

A Table-Driven Control Method to Meet Continuous, Near-Real-Time Observation Requirements for the Solar X-Ray Imager

Wallace, Shawn, NASA Marshall Space Flight Center, USA; Brown, Terry, NASA Marshall Space Flight Center, USA; Freestone, Kathleen, NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Ditital Avionics SC, 31 Oct. - 6 Nov. 1998, Seattle,

The design of the Solar X-Ray Imager (SXI) for the Geostationary Operational Environmental Satellite (GOES) presents an unusual scenario for controlling the observing sequences. The SXI is an operational instrument, designed not primarily for scientific research, but for providing "operational" data used by the National Oceanic and Atmospheric Administration (NOAA) to forecast the near-term space weather. to this end, a sequence of images selected to cover the full dynamic range of the sun will be executed routinely. As the dynamics of the sun have differing temporal cadences, the frequency of various images will differ. These images must be routinely received at the forecast center in near real-time, 24-hours a day, with a minimum of interruptions. While these requirements clearly lead to a 'routine patrol' of images, the parameters for each do not form a static set. The dynamics of the sun will change with the I 1-year solar cycle. The performance of the imaging will vary with on-orbit conditions and time. and while the SXI is not intended as a research instrument, forecasting techniques may change with time, which in turn will further alter the imaging sequences. An additional complication is the highly restricted commanding window, and a very slow commanding rate. to fulfill these requirements, the SXI was designed to utilize a table-driven approach. Sequences are defined using structured loops, with nested repetitions and delays. These sequences reference combinations of imaging parameters which in turn reference tables of parameters than can be loaded by ground commands. Multiple sequences can be built and stored in preparation for execution when determined appropriate by the NOAA forecasters. The result is an approach that can be used to provide a flexible, yet autonomous SXI capable of meeting both arbitrary forecasting requirements, and operating within the commanding constraints.

Author

Real Time Operation; Solar X-Rays; Imaging Techniques; Forecasting; Dynamic Range; Control Equipment

19990102607 NASA Goddard Space Flight Center, Greenbelt, MD USA

Generation of Electron Suprathermal Tails in the Upper Solar Atmosphere: Implications for Coronal Heating

Vinas, Adolfo F., NASA Goddard Space Flight Center, USA; Wong, Hung K., NASA Goddard Space Flight Center, USA; Klimas, Alexander J., NASA Goddard Space Flight Center, USA; 1999; 2p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche; Abstract Only; Abstract Only

We present a mechanism for the generation of non-Maxwellian electron distribution function in the upper regions of the solar atmosphere in the presence of collisional damping. It is suggested that finite amplitude, low frequency, obliquely propagating electromagnetic waves can carry a substantial electric field component parallel to the mean magnetic field that can be significantly larger than the Dreicer electric field. This long wavelength electric fluctuation is capable of generating high frequency electron plasma oscillations and low frequency ion acoustic-like waves. The analysis has been performed using 1-1/2D Vlasov and PIC numerical simulations in which both electrons and ions are treated kinetically and self consistently. The simulation results indicate that high frequency electron plasma oscillations and low frequency ion acoustic-like waves are generated. The high frequency electron plasma oscillation drives electron plasma turbulence, which subsequently is damped out by the background electrons. The turbulence damping results in electron acceleration and the generation of non-Maxwellian suprathermal tails on time scales short compared to collisional damping. Bulk heating also occurs if the fluctuating parallel electric field is strong enough. This study suggests that finite amplitude, low frequency, obliquely propagating, electromagnetic waves can play a significant role in the acceleration and heating of the solar corona electrons and in the coupling of medium and small-scale phenomena.

Author

Chromosphere; Electric Fields; Electron Acceleration; Electron Plasma; Plasmas (Physics); Solar Atmosphere; Solar Corona; Plasma Waves; Electron Distribution; Solar Magnetic Field; Electromagnetic Fields

19990102868 Memphis Univ., Memphis, TN USA

Solar Flares and Their Prediction

Adams, Mitzi L., Memphis Univ., USA; Jan. 27, 1999; 1p; In English, 27 Jan. 1999, Memphis, TN, USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Solar flares and coronal mass ejection's (CMES) can strongly affect the local environment at the Earth. A major challenge for solar physics is to understand the physical mechanisms responsible for the onset of solar flares. Flares, characterized by a sudden release of energy (approx. 10(exp 32) ergs for the largest events) within the solar atmosphere, result in the acceleration of electrons, protons, and heavier ions as well as the production of electromagnetic radiation from hard X-rays to km radio waves (wavelengths approx. = 10(exp -9) cm to 10(exp 6) cm). Observations suggest that solar flares and sunspots are strongly linked. For example, a study of data from 1956-1969, reveals that approx. 93 percent of major flares originate in active regions with spots. Furthermore, the global structure of the sunspot magnetic field can be correlated with flare activity. This talk will review what

we know about flare causes and effects and will discuss techniques for quantifying parameters, which may lead to a prediction of solar flares.
Author
Solar Flares; Predictions; Coronal Mass Ejection; Solar Magnetic Field

19990102886 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
Variations in Solar Extreme Ultraviolet Radiation and Their Effects on the Above-Earth Atmosphere *Variasi Radiasi Extreem Ultra Violet Matahari Dan Pengaruhnya Pada Lapisn Atmosfer Atas Bumi*
Suratno, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July 1998; ISSN 0126-0480; Volume 22, No. 86, pp. 32-40; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
    Variability of solar ultraviolet radiation influences the Earth's atmosphere condition especially in the middle and upper layers. This paper explained that this influence happened indirectly. This can be seen on the value of the correlation coefficient between the variation of EUV intensity (121.6 mn) and of the atmosphere's temperature which is smaller than 57% (except on 50 mBar altitude approximately equals 70%). However, the value of correlation coefficient between the variation of the total EUV intensity and the mean atmosphere temperature per 27 days (approximately equals the solar rotation) is as high as 70%. We can interpret this result that the variation of earth's atmosphere temperature is influenced by an energy package from the sun.
Author
Solar Physics; Variations; Solar Radiation; Extreme Ultraviolet Radiation; Earth Atmosphere

19990102892 Lembaga Penerbangan dan Antariksa Nasional, Jakarta, Indonesia
Effects of Long-Term Solar Activity and Irradiation Variation at Sea Surface Temperatures (SST) Around the Equator *Pengaruh Variabilitas Aktivitas dan Irradiansi Matahari Jangka Panjang Pada Suhu Permukaan Laut (SST) di Sekitar Ekuator*
Sinambela, Wilson, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Kilowasid, L. Muh. Musafar, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Cahyono, Waluyo Eko, Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Kambri, dan Maspul Aini., Lembaga Penerbangan dan Antariksa Nasional, Indonesia; Majalah LAPAN; July 1998; ISSN 0126-0480; Volume 22, No. 86, pp. 24-31; In Malay-Indonesian; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche
    Influence of long-term solar and irradiance variability on the sea surface temperature around equator within latitude +/- 50 deg was studied based on data during 1949 - 1988. Spectral analysis of sea surface temperatures showed a number dominant periods: 1 year related with monsoon changes, 3-6 year related with El Nino Southern Oscillation (ENSO), and 10,45 year related with solar cycle. Analysis of the influence of long-term solar variability on the average sea surface temperature showed a strong similarity between average sea surface temperature and 11 - year solar activity cycle. Linear correlation analysis between 11 - year average sea surface temperature and sunspot number (after removing short-term variation and the effect-ENSO) we found a strong correlation with correlation coefficient of 0,79.
Author
Solar Physics; Solar Activity; Irradiation; Solar Activity Effects; Sea Surface Temperature; Equators; Variations

19990103008 NASA Marshall Space Flight Center, Huntsville, AL USA
The Sun in Time
Adams, Mitzi L., NASA Marshall Space Flight Center, USA; Bero, Elizabeth, NASA Marshall Space Flight Center, USA; Sever, Thomas L., NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 25 Jun. 1999, Jacksonville, FL, USA; Sponsored by Southeastern Plantarium Association; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only
    Leveraging funds from NASA's Initiative to Develop Education through Astronomy and Space Science (IDEAS) program, we combined the expertise of an archaeoastronomer, a solar scientist, and a teacher to trace humankind's view of the Sun and how that has changed, from the time of Stonehenge in about 1800 B.C.E., to the time of the Maya in 700 C.E., up to the modem era. Our program was aimed at middle-school students in an attempt to explain not only how science is done today, but how science has evolved from the observations of ancient societies. From these varied cultures, we touched on methods of observing the Sun, ideas of the composition of the Sun, and the relationship of the Sun to everyday life. Further, using the von Braun Astronomical Society's Planetarium in Huntsville, Alabama as a test-bed for the program, we illustrated concepts such as solstices, equinoxes, and local noon with approximately 800 eighth grade students from the local area. Our presentation to SEPA will include a description of NASA's IDEAS program and how to go about partnering with a NASA astronomer, some slides from our planetarium program and web-site, and some hands-on activities.
Author
Space Programs; Solstices; Education; Chutes

Education and Public Outreach for MSFC's Ground-Based Observations in Support of the HESSI Mission

Adams, Mitzi L., NASA Marshall Space Flight Center, USA; Hagyard, Mona J., NASA Marshall Space Flight Center, USA; Newton, Elizabeth K., NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 2 Jun. 1999, Chicago, IL, USA; Sponsored by American Astronautical Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A primary focus of NASA is the advancement of science and the communication of these advances to a number of audiences, both within the science research community and outside it. The upcoming High Energy Solar Spectroscopic Imager (HESSI) mission and the MSFC ground-based observing program, provide an excellent opportunity to communicate our knowledge of the Sun, its cycle of activity, the role of magnetic fields in that activity, and its effect on our planet. In addition to ground-based support of the HESSI mission, MSFC's Solar Observatory, located in North Alabama, will involve students and the local education community in its day-to-day operations, an experience which is more immediate, personal, and challenging than their everyday educational experience. Further, by taking advantage of the Internet, our program can reach beyond the immediate community. by joining with Fernbank Science Center in Atlanta, Georgia, we will leverage their almost 30 years' experience in science program delivery in diverse situations to a distance learning opportunity which can encompass the entire Southeast and beyond. This poster will outline our education and public outreach plans in support of the HESSI mission in which we will target middle and high school students and their teachers.
Author
Education; Magnetic Fields; Solar Observatories

Helicity of Photospheric Magnetic Fields in Solar Cycle 21

Hagyard, Mona J., NASA Marshall Space Flight Center, USA; Pevtsov, Alexei A., NASA Marshall Space Flight Center, USA; Canfield, Richard C., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Magnetic Helicity, 28 Jul. 1998, Boulder, CO, USA; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Recent analyses of photospheric vector magnetic fields observed during solar cycle 22 have indicated a hemispherical selection rule for magnetic helicity with a predominance of negative (positive) helicity in the northern (southern) hemisphere. Using the extensive data base from the Marshall Space Flight Center's solar vector magnetograph, we have begun a study to derive the helicity for active regions observed during solar cycle 21 and confirm the hemispherical helicity rule for a different solar cycle. In this poster paper, we will present our initial results for several active regions observed in 1980 near the peak of cycle 21, as well as results from analyses designed to test quantitatively the methods used in calculating the helicity.
Author
Photosphere; Solar Magnetic Field; Solar Wind

Can Kelvin-Helmholtz Instabilities of Jet-Like Structures and Plumes Cause Solar Wind Fluctuations at 1AU

Parhi, Shyamsundar, NASA Marshall Space Flight Center, USA; Suess, Steven T., NASA Marshall Space Flight Center, USA; Sulkanen, Martin E., NASA Marshall Space Flight Center, USA; 1998; 1p; In English, 26 May 1998, Boston, MA, USA; Sponsored by American Geophysical Union; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

During its south polar passage in 1994, Ulysses sampled the solar wind emerging from the south polar coronal hole. In analysing these data two types of density fluctuations lasting a few hours have been reported, one characterized by fluctuations in velocity gradients ("microstreams") and the other by magnetic plus thermal-pressure balance structures ("PBS"). Microstreams were both temporal and spatial in nature. At higher frequencies, MHD turbulence was observed and found to be less evolved than in the ecliptic, but essentially independent of heliographic latitude. It is argued here that microstreams, PBS, and MHD turbulence could all be the remnant of shears associated with plumes and other filamentary structures ("jets") which have been reported to exist in coronal holes. The shear between a jet and its ambient can become unstable to the MHD Kelvin-Helmholtz ("KH') instability at 5-10 solar radius and the propagating instability can cause fluctuations like those seen by Ulysses. This motivates us to simulate coronal jets using a 3D MHD ZEUS code. The first 2D results have just started to come and are promising. to study the KH instability the jet is perturbed at the boundary with a linear amplitude and fixed frequency. The jet seems to pass through various distinct phases, one of which Is apparently dominated by KH instabilities. These instabilities drive oblique shocks into the jet as the turbulent eddies contact the jet surface. It is known that KH instabilities and internal shock waves are partially suppressed by magnetic field tension. Hence, in simulating far along the jet the Instability is expected to produce Alfvenic fluctuations like those seen near 1 AU.
Author
Solar Wind; Sampling; Data Processing; Temperature Measurement; Magnetohydrodynamic Turbulence; Magnetohydrodynamic Stability

19990103162 NASA Marshall Space Flight Center, Huntsville, AL USA
Estimating the Size and Timing of Maximum Amplitude for Cycle 23 from Its Early Cycle Behavior
Wilson, Robert M., NASA Marshall Space Flight Center, USA; Hathaway, David H., NASA Marshall Space Flight Center, USA; Reichmann, Edwin J., NASA Marshall Space Flight Center, USA; 1998; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

On the basis of the lowest observed smoothed monthly mean sunspot number, cycle 23 appears to have conventionally begun in May 1996, in conjunction with the first appearance of a new cycle, high-latitude spot-group. Such behavior, however, is considered rather unusual, since, previously (based upon the data- available cycles 12-22), the first appearance of a new cycle, high-latitude spot- group has always preceded conventional onset by at least 3 months. Furthermore, accepting May 1996 as the official start for cycle 23 poses a dilemma regarding its projected size and timing of maximum amplitude. Specifically, from the max-min and amplitude-period relationships we infer that cycle 23 should be above average in size and a fast riser, with maximum amplitude occurring before May 2000 (being in agreement with projections for cycle 23 based on precursor information), yet from its initial languid rate of rise (during the first 6 months of the cycle) we infer that it should be below average in size and a slow riser, with maximum amplitude occurring after May 2000. The dilemma vanishes, however, when we use a slightly later-occurring onset. For example, using August 1996, a date associated with a local secondary minimum prior to the rapid rise that began shortly thereafter (in early 1997), we infer that cycle 23's rate of rise is above that for the mean of cycles 1-22, the mean of cycles 10-22 (the modern era cycles), the mean of the modern era 'fast risers,' and the largest of the modern era 'slow risers' (i.e., cycle 20), thereby, suggesting that cycle 23 will be both fast-rising and above average in size, peaking before August 2000. Additionally, presuming cycle 23 to be a well- behaved fast-rising cycle (regardless of whichever onset date is used), we also infer that its maximum amplitude likely will measure about 144.0 q+/- 28.8 (from the general behavior found for the bulk of modern era fast risers; i.e., 5 of 7 have had their maximum amplitude to lie within 20% of the mean curve for modern era fast risers). It is apparent, then, that sunspot number growth during 1998 will prove crucial for correctly establishing the size and shape of cycle 23.
Author
Estimating; Size (Dimensions); Rates (Per Time); Amplitudes; Cycles

19990103167 NASA Marshall Space Flight Center, Huntsville, AL USA
On Heating Large Bright Coronal Loops by Magnetic Microexplosions at their Feet
Moore, Ronald L, NASA Marshall Space Flight Center, USA; Falconer, D. A., NASA Marshall Space Flight Center, USA; Porter, Jason G., NASA Marshall Space Flight Center, USA; Jun. 01, 1999; 1p; In English, 30 May - 3 Jun. 1999, Chicago, IL, USA; Sponsored by American Astronomical Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

In previous work, by registering Yohkoh SXT coronal X-ray images with MSFC vector magnetograms, we found that: (1) many of the larger bright coronal loops rooted at one or both ends in an active region are rooted around magnetic islands of included polarity, (2) the core field encasing the neutral line encircling the island is strongly sheared, and (3) this sheared core field is the seat of frequent microflares. This suggests that the coronal heating in these extended bright loops is driven by many small explosive releases of stored magnetic energy from the sheared core field at their feet, some of which magnetic microexplosions also produce the microflare heating in the core fields. In this paper, we show that this scenario is feasible in terms of the energy Abstract: required for the observed coronal heating and the magnetic energy available in the observed sheared core fields. In a representative active region, from the X-ray and vector field data, we estimate the coronal heating consumption by a selected typical large bright loop, the coronal heating consumption by a typical microflare at the foot of this loop, the frequency of microflares at the foot, and the available magnetic energy in the microflaring core field. We find that: (1) the rate of magnetic energy release to power the microflares at the foot (approx. 6×10^{25} erg/s) is enough to also power the coronal heating in the body of the extended loop (approx. 2×10^{25} erg/s), and (2) there is enough stored magnetic energy in the sheared core field to sustain the microflaring and extended loop heating for about a day, which is a typical time for buildup of neutral-line magnetic shear in an active region. This work was funded by the Solar Physics Branch of NASA's Office of Space Science through the SR&T Program and the SEC Guest Investigator Program.
Author
Magnetic Signatures; Magnetic Cores; Heating; Coronal Loops

19990103373 Los Alamos National Lab., NM USA
Transient aspects of stream interface signatures
Crooker, N. U.; Shodhan, S.; Forsyth, R. J.; Burton, M. E.; Gosling, J. T.; Dec. 31, 1999; 5p; In English; 9th; International conference on solar wind
Report No.(s): DE99-002741; LA-UR-99-946; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Although stream interfaces are steady-state, corotating boundaries between slow and fast solar wind, their signatures are sometimes associated with transient features. Here the authors illustrate two modes of association: interfaces trailing interplanetary coronal mass ejections (ICMEs) at 1 AU and interfaces within ICMEs in the range 4--5 AU. The former are readily understood as boundaries between transient slow wind and steady-state fast wind, where the ICMEs add variability to the interface signatures. The latter are puzzling and may be related to evolution of interfaces.

NTIS

Solar Wind; Solar Corona; Interplanetary Space; Stellar Mass Ejection

19990104291 Denver Univ., Dept. of Physics, Denver, CO USA

Quantification of HCl from High Resolution Infrared Solar Spectra Obtained at the South Pole in December 1986

Goldman, A., Denver Univ., USA; Murcray, F. J., Denver Univ., USA; Murcray, F. H., Denver Univ., USA; Murcray, D. G., Denver Univ., USA; Geophysical Research Letters; June 1987; ISSN 0094-8276; Volume 14, No. 6, pp. 622-623; In English

Report No.(s): Paper-7L6546; Copyright; Avail: Issuing Activity, Hardcopy

Ground-based infrared solar spectra at 0.02 /cm resolution obtained at the AmundsenScott South Pole station in December 1986 have been analysed for the atmospheric content of HCl. Nonlinear least-squares spectral fitting applied to the spectra yields a total HCl column amount of (6.4 +/- 0.8) x 10(exp 15) molec/sq cm, most being stratospheric. This amount is larger than that extrapolated from earlier results on the latitudinal distribution of atmospheric HCl.

Author

Quantitative Analysis; Hydrogen Chlorides; Infrared Spectra; Solar Spectra

19990104322 NASA Marshall Space Flight Center, Huntsville, AL USA

Chromospheric Evolution and the Flare Activity of Super-Active Region NOAA 6555

PrasadC, Debi, Udaipur Solar Observatory, India; Ambastha, Ashok, Udaipur Solar Observatory, India; Srivastava, Nandita, Udaipur Solar Observatory, India; Tripathy, Sushanta C., Udaipur Solar Observatory, India; Hagyard, Mona J., NASA Marshall Space Flight Center, USA; Journal of Astrophysics and Astronomy; March 1997; Volume 18, No. 1, pp. 39-55; In English; Copyright; Avail: Issuing Activity, Hardcopy, Microfiche

Super-active region NOAA 6555 was highly flare productive during the period March 21st - 27th, 1991 of its disk passage. We have studied its chromospheric activity using high spatial resolution H alpha filtergrams taken at Udaipur along with MSFC vector magnetograms. A possible relationship of flare productivity and the variation in shear has been explored. Flares were generally seen in those subareas of the active region which possessed closed magnetic field configuration, whereas only minor flares and/or surges occurred in subareas showing open magnetic field configuration. Physical mechanisms responsible for the observed surges are also discussed.

Author

Chromosphere; Magnetic Field Configurations; Magnetic Signatures; Solar Flares; H Alpha Line; Magnetic Fields; Sunspots

19990105828 NASA Marshall Space Flight Center, Huntsville, AL USA

Using Strong Solar Coronal Emission Lines as Coronal Flux Proxies

Falconer, David A., NASA Marshall Space Flight Center, USA; Jordan, Studart D., NASA Goddard Space Flight Center, USA; Davila, Joseph M., NASA Goddard Space Flight Center, USA; Thomas, Roger J., NASA Goddard Space Flight Center, USA; Andretta, Vincenzo, NASA Goddard Space Flight Center, USA; Brosius, Jeffrey W., Hughes STX, USA; Hara, Hirosha, National Astronomical Observatory, Japan; [1997]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

A comparison of Skylab results with observations of the strong EUV lines of Fe XVI at 335 A and 361 A from the Goddard Solar EUV Rocket Telescope and Spectrograph (SERTS) flight of 1989 suggests that these lines, and perhaps others observed with SERTS, might offer good proxies for estimating the total coronal flux over important wavelength ranges. In this paper, we compare SERTS observations from a later, 1993 flight with simultaneous cospatial Yohkoh soft X-ray observations to test this suggestion over the energy range of the Soft X-ray Telescope (SXT) on Yohkoh. Both polynomial and power-law fits are obtained, and errors are estimated, for the SERTS lines of Fe XVI 335 A and 361 A, Fe XV 284 A and 417 A, and Mg IX 368 A. It is found that the power-law fits best cover the full range of solar conditions from quiet Sun through active region, though not surprisingly the 'cooler' Mg IX 368 A line proves to be a poor proxy. The quadratic polynomial fits yield fair agreement over a large range for all but the Mg IX line, but the linear fits fail conspicuously when extrapolated into the quiet Sun regime. The implications of this work for the He 11 304 A line formation problem are briefly considered. The paper concludes with a discussion of the value of these iron lines observed with SERTS for estimating stellar coronal fluxes, as observed for example with the EUVE satellite.

Author

Coronas; Emission Spectra; Extreme Ultraviolet Radiation; Solar Activity; Solar Corona; Sun

Includes cosmic radiation; and inner and outer earth's radiation belts. For biological effects of radiation see 52 Aerospace Medicine. For theory see 73 Nuclear and High-Energy Physics.

19990101876 New Hampshire Univ., Physics Dept., Durham, NH USA
Rossi X-Ray Timing Explorer Observations of the Gamma-Ray Blazar PKS 2155-304 *Final Report*
Vestrand, W. Thomas, New Hampshire Univ., USA; [1999]; 4p; In English
Contract(s)/Grant(s): NAG5-3815; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

    PKS 2155-304 is the archetypical X-ray-selected BL Lac object (XBL). It is one of the brightest BL Lacs at x-ray through optical wavelengths where it has a relatively featureless continuum and displays rapid, large amplitude variability. This continuum is thought to be direct synchrotron emission from a distribution of ultra-relativistic electrons which extends to unusually high energies (Edelson et al. 1995). The gamma-ray emission from PKS 2155-304 constitutes a second, separate, spectral component. Observations with the EGRET telescope aboard the Compton Gamma Ray Observatory (CGRO) show that the spectral energy distribution of this gamma-ray component must peak at energies above 10 GeV (Vestrand et al. 1995). This, plus the realization that the extension of the synchrotron component into the x-ray band meant that ambient photons would be scattered to TeV energies, led to predictions that PKS 2155-304 would be a detectable TeV gamma ray source (Vestrand et al. 1995; Stecker et al. 1996). The University of Durham group has recently reported the discovery of TeV gamma ray emission from PKS 2155-304 (Chadwick et al. 1998, 1999) . The TeV emission was detected in 1996 September and 1997 October/November, with the largest fluxes being measured in 1997 November. During 1997 November, we detected a record high GeV gamma-ray flux from PKS 2155-304 with CGRO/EGRET (SReekumar and Vestrand 1997) and subsequently very high x-ray fluxes were measured with BeppoSAX (Chiapeeti et al. 1997). Here we report on the record x-ray fluxes measured with the Rossi X-Ray Timing Explorer (RXTE) during the GeV/TeV outburst.
Author
Blazars; Display Devices; Gamma Ray Observatory; Photons; Spectral Energy Distribution; Time Measurement; Variability

19990102217 NASA Marshall Space Flight Center, Huntsville, AL USA
The Magnetic Roots of Enhanced Coronal Heating
Porter, J. G., NASA Marshall Space Flight Center, USA; 1998; In English; Solar Jets and Polar Plumes, 23-27 Feb. 1998, Pointe a Pitre, France; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

    Building a description of the sites of enhanced heating in the solar atmosphere has been a primary interest of the solar group at MSFC. For locations within and between active regions, as well as in the quiet Sun, this work shows that extended magnetic structures are heated from active compact magnetic structures at their feet. This talk will review what we have learned about the magnetic characteristics of these active footpoint sites, and the relationships of the intensity variations in the low-lying and higher structures, in the context of current theories and observations of magnetic reconnection and jets. One puzzling result is the poor correlation of intensity variations in the low and high loops.
Author
Heating; Solar Atmosphere; Magnetic Field Configurations; Coronas

19990102614 NASA Marshall Space Flight Center, Huntsville, AL USA
Origin of Gamma-Ray Emissions from the MeV Blazars
Ghosh, K. K., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; 1999; In English; 3rd; INTEGRAL Workshop: The Extreme Universe, 14-18 Sep. 1998, Taormina, Italy; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

    More than sixty gamma-ray emitting blazars have been detected by the Compton Gamma Ray Observatory (CGRO). A subclass of these blazars is known as MeV blazars that are most luminous at the MeV energies. Spectra of these sources show a break somewhere between 1 MeV and 30 MeV with break amplitude as large as DELTA-GAMMA = 1.5. Different models like Compton cooling jet models, synchrotron self-Compton models, etc., have been suggested to explain the observed properties of the MeV luminous blazars. However these models are unable to account for spectral break amplitudes in excess of 0.5. Here we suggest an inverse-Compton model based on recent published experimental data where MeV gamma rays were produced via Compton backscattering of UV photons with 500 MeV electrons. We show that the high energy electrons of the relativistic jet can collide with the copious ultraviolet photons of the big blue bump of the blazar, and produce photons peaked in the MeV region. Also we show that the X rays and the soft gamma rays in these sources are produced through the synchrotron self-Compton process. Flux

computed from our model have been used to compare with the observed X-ray/gamma-ray spectra of the MeV luminous blazars. Details of the model are discussed in the present paper.

Author

Blazars; Gamma Rays; Emission Spectra; Gamma Ray Observatory

19990102621 NASA Marshall Space Flight Center, Huntsville, AL USA

Major Optical Outburst of Two Blazars: 3C66A and OJ287

Ghosh, K. K., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Soundararajaperumal, S., Indian Inst. of Astrophysics, India; Pukalenthi, S., Indian Inst. of Astrophysics, India; Rosario, M. J., Indian Inst. of Astrophysics, India; 1999; 1p; In English; 194th, 30 May - 3 Jun. 1999, Chicago, IL, USA; Sponsored by American Astronautical Society; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Differential CCD photometric observations of 3C66A and OJ287 were carried out on 16 and 35 nights between December 1995 and March 1996, at the Vainu Bappu Observatory, India, as part of the blazar monitoring program. During this period we detected major optical outbursts (brightness of 3C66A and OJ287 increased by 0.8 and 1 mag, respectively) of these two blazars on timescales of two months. Integrating the outburst profiles we find that both the blazars released around 10(exp 53) erg. Such large amount of energy may come from the release of binding energy of a compact star when tidally disrupted by a super-massive black hole at the center of these blazars. Also we extend this model to explain the observed multifrequency (radio through gamma-ray) outburst of these two blazars and show that this model will be able to explain the outburst phenomena of other blazars. These new results will be presented with a detailed discussion of the suggested model.

Author

Optical Activity; Brightness; Gamma Rays; Blazars; Black Holes (Astronomy)

19990102867 NASA Marshall Space Flight Center, Huntsville, AL USA

A Non-Triggered Burst Supplement to the BATSE Gamma-Ray Burst Catalogs

Kommers, J., NASA Marshall Space Flight Center, USA; Lewin, W. H., NASA Marshall Space Flight Center, USA; Kouveliotou, C., NASA Marshall Space Flight Center, USA; vanParadijs, J., NASA Marshall Space Flight Center, USA; Pendleton, G. N., NASA Marshall Space Flight Center, USA; Meegan, C. A., NASA Marshall Space Flight Center, USA; Fishman, G. J., NASA Marshall Space Flight Center, USA; [1998]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory detects gamma-ray bursts (GRBs) with a real-time burst detection (or "trigger") system running onboard the spacecraft. Under some circumstances, however, a GRB may not activate the onboard burst trigger. For example, the burst may be too faint to exceed the onboard detection threshold, or it may occur while the onboard burst trigger is disabled for technical reasons. This paper is a catalog of such "non-triggered" GRBs that were detected in a search of the archival continuous data from BATSE. It lists 873 non-triggered bursts that were recorded between 1991 December 9.0 and 1997 December 17.0. For each burst, the catalog gives an estimated source direction, duration, peak flux, and fluence. Similar data are presented for 50 additional bursts of unknown origin that were detected in the 25-50 keV range; these events may represent the low-energy "tail" of the GRB spectral distribution. This catalog increases the number of GRBs detected with BATSE by 48% during the time period covered by the search.

Author

Gamma Ray Bursts; Observation; Real Time Operation; Detection

19990102877 NASA Goddard Space Flight Center, Greenbelt, MD USA

Multi-Wavelength Observations of 3C 273 in 1993-1995

vonMontigny, C., NASA Goddard Space Flight Center, USA; Aller, H., Michigan Univ., USA; Aller, M., Michigan Univ., USA; Bruhweiler, F., Catholic Univ. of America, USA; Collmar, W., Max-Planck-Inst. fuer Extraterrestrische Physik, Germany; Courvoisier, T. J.–L., INTEGRAL Science Data Center, Switzerland; Edwards, P. G., Tokyo Univ., Japan; Fichtel, C. E., NASA Goddard Space Flight Center, USA; Fruscione, A., Harvard-Smithsonian Center for Astrophysics, USA; Ghisellini, G., Osservatorio Astronomico di Brera, Italy; 1997; 78p; In English

Contract(s)/Grant(s): NCC5-93; NCC5-95; BMBF-50-QV-9095; DFG-SFB-328; NAG5-2508; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

We present the results of the multi-wavelength campaigns on 3C 273 in 1993-1995. During the observations in late 1993 this quasar showed an increase of its flux for energies is greater than = 100 MeV from about 2.1 x 10(exp -7) photons/sq cm.s to approximately 5.6 x 10(exp -7) photons/sq cm.s during a radio outburst at 14.5, 22 and 37 GHz. However, no one-to-one correlation of the gamma-ray radiation with any frequency could be found. The photon spectral index of the high energy spectrum changed from GAMMA(sub gamma) = (3.20 +/- 0.54) to GAMMA(sub gamma) = (2.20 +/- 0.22) in the sense that the spectrum flattened when

the gamma-ray flux increased. Fits of the three most prominent models (synchrotron self-Comptonization, external inverse Comptonization and the proton initiated cascade model) for the explanation of the high gamma-ray emission of active galactic nuclei were performed to the multi-wavelength spectrum of 3C 273 . All three models are able to represent the basic features of the multi-wavelength spectrum. Although there are some differences the data are still not decisive enough to discriminate between the models.

Author

Gamma Rays; Emission Spectra; Gamma Ray Spectra; Energy Spectra; Gamma Ray Astronomy; Gamma Ray Sources (Astronomy); Spectrum Analysis; Radio Astronomy

19990103020 NASA Marshall Space Flight Center, Huntsville, AL USA

Generic Signatures of the Time Profiles of Cosmic Gamma-Ray Bursts

Mitrofanov, Igor G., NASA Marshall Space Flight Center, USA; Pozanenko, Alexei S., NASA Marshall Space Flight Center, USA; Briggs, Michael S., NASA Marshall Space Flight Center, USA; Paciesas, W. S., NASA Marshall Space Flight Center, USA; Preece, Robert D., NASA Marshall Space Flight Center, USA; Pendleton, Geoffrey N., NASA Marshall Space Flight Center, USA; Meegan, Charles A., NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

A new method is proposed which allows the study of the most generic signatures of the time histories of cosmic gamma-ray bursts. We average, with 64 ms time resolution, the time profiles of 275 bright bursts detected by BATSE. The profile of each burst is normalized by the maximum number of counts Cmax at the peak of the primary pulse, and individual pulses and interpulse valleys are selected from the normalized profiles by an identical selection criteria. New temporal parameters are introduced which characterize the duration and equivalent width of each pulse and the duration of each valley.

Author

Cosmic Rays; Gamma Ray Bursts; Gamma Ray Astronomy

19990103100 NASA Marshall Space Flight Center, Huntsville, AL USA

Discovery of a New Soft Gamma Repeater, SGR 1627-41

Woods, Peter, NASA Marshall Space Flight Center, USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; van-Paradijs, Jan, NASA Marshall Space Flight Center, USA; Hurley, K., NASA Marshall Space Flight Center, USA; Kippen, Richard M., NASA Marshall Space Flight Center, USA; Finger, Mark H., NASA Marshall Space Flight Center, USA; Briggs, Michael S., NASA Marshall Space Flight Center, USA; Dieters, Stefan, NASA Marshall Space Flight Center, USA; Fishman, Gerald J., NASA Marshall Space Flight Center, USA; 1999; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We report the discovery of a new soft gamma repeater (SGR), SGR 1627-41, and present BATSE observations of the burst emission and BeppoSAX NFI observations of the probable persistent X-ray counterpart to this SGR. All but one burst spectrum are well fit by an optically thin thermal bremsstrahlung (OTTB) model with kT values between 25 and 35 keV. The spectrum of the X-ray counterpart, SAX J1635.84736, is similar to that of other persistent SGR X-ray counterparts. We find weak evidence for a periodic signal at 6.41 s in the light curve for this source. Like other SGRs, this source appears to be associated with a young supernova remnant G337.0-0.1. Based upon the peak luminosities of bursts observed from this SGR, we find a lower limit on the dipole magnetic field of the neutron star B_dipole greater than 5e10(exp 14) Gauss.

Author

Gamma Ray Bursts; Supernova Remnants; Repeaters; Neutron Stars

19990103101 NASA Marshall Space Flight Center, Huntsville, AL USA

BeppoSAX Observations of the SGR 1900+14 in Quiescence and During an Active Period

Woods, Peter, NASA Marshall Space Flight Center, USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; van-Paradijs, Jan, NASA Marshall Space Flight Center, USA; Finger, Mark H., NASA Marshall Space Flight Center, USA; Thompson, Christopher, NASA Marshall Space Flight Center, USA; 1999; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We present results from two Beppo SAX Narrow Field Instrument (NFI) observations of SGR-1900+14 made during a quiescent and an active period of the source. We detect pulsations in the 1997 May 12-13 observation (quiescence) at 5.157190(7) sec and the 1998 September 15-16 observation (active period) at 5.16026](12) sec. Using results reported by Hurley et al. (1999a), we establish a long-term spin down rate during quiescence of 5.82(2)-approx. times 10(exp -11) s/s which implies a dipole mag-

netic field of sim 5.5 approx. times 10(exp 14) G. We confirm deviations from a constant spin down rate during the active period. We also find spectral similarities between SGR-1900+14 in quiescence and anomalous X-ray pulsars (AXPs).
Author
Data Acquisition; Observation; Pulsars; Unsteady Flow

19990103154 NASA Marshall Space Flight Center, Huntsville, AL USA
Radio Sources in Galaxy Clusters at 28.5 GHz
Cooray, Asantha R., Chicago Univ., USA; Grego, Laura, Chicago Univ., USA; Holzapfel, William L., Chicago Univ., USA; Joy, Marshall, NASA Marshall Space Flight Center, USA; Carlstrom, John E., Chicago Univ., USA; [1998]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We present serendipitous observations of radio sources at 28.5 GHz (1 cm), which resulted from our program to image thermal Sunyaev-Zeldovich (SZ) effect in 56 galaxy clusters. In a total area of about 0.8 degrees sq., we find 64 radio sources with fluxes down to - 0.4 mJy (> 4sigma,), and within 250" from the pointing centers. The spectral indices (S varies as v(sup -alpha) of 54 sources with published low frequency flux densities range from -0.6 approximately is less than alpha and alpha approximately is less than 2 with a mean of 0.77 +/- 0.06, and a median of 0.84. Extending low frequency surveys of radio sources towards galaxy clusters CL 0016+16, Abell 665, and Abell 2218 to 28.5 GHz, and selecting sources with S(sub l.4GHz) is greater than /= 7 mJy to form an unbiased sample, we find a mean spectral index of 0.71 +/- 0.08 and a median of 0.71. We find 4 to 7 times more sources predicted from a low frequency survey in areas without galaxy clusters. This excess cannot be accounted for by gravitational lensing of a background radio population by cluster potentials, indicating most of the detected sources are associated with galaxy clusters. The differential source count slope, gamma is approximately 1.96 (dN/dS varies as S(exp -gamma)), is flatter than what is expected for a nonevolving Euclidean population (gamma = 2.5). For the cluster Abell 2218, the presence of unsubtracted radio sources with S(sub 28.5GHz) is approximately is less than 0.5 mJy (- 5 sigma), can only contribute to temperature fluctuations at a level of DeltaT is approximately 10 to 25 microK. The corresponding error due to radio point source contamination in the Hubble constant derived through a combined analysis of 28.5 GHz SZ images and X-ray emission observations ranges from 1% to 6%.
Author
Background Radiation; Continuums; Galactic Clusters; Radio Astronomy; Radio Sources (Astronomy)

19990103169 NASA Marshall Space Flight Center, Huntsville, AL USA
Observational Review of Gamma-Ray Bursts
Fishman, Gerald J., NASA Marshall Space Flight Center, USA; 1999; 1p; In English, 3-6 May 1999, Baltimore, MD, USA; Sponsored by Space Telescope Science Inst., USA; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

The observed gamma-ray temporal, spectral, intensity and spatial distribution characteristics of GRBs, primarily from data obtained from the Compton Observatory, will be described. The talk will concentrate on recent studies of burst properties, correlations of GRB parameters and other statistical studies that have only recently come to light with the unprecedented sample of over two thousand GRBs, along with some mention of studies in progress by members of the BATSE team.
Author
Observatories; Gamma Ray Bursts; Spectra; Brightness

19990103170 NASA Marshall Space Flight Center, Huntsville, AL USA
Spectral Energy Distributions and Light Curves of GRB 990123 and Its Afterglow
Galama, T. J., NASA Marshall Space Flight Center, USA; Briggs, M. S., NASA Marshall Space Flight Center, USA; Wijers,R. A. M. J., NASA Marshall Space Flight Center, USA; Vreeswijk, P. M., NASA Marshall Space Flight Center, USA; Rol, E., NASA Marshall Space Flight Center, USA; Band, D., NASA Marshall Space Flight Center, USA; vanParadijs, J., NASA Marshall Space Flight Center, USA; Kouveliotou, C., NASA Marshall Space Flight Center, USA; Preece, R. D., NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Gamma-ray bursts (GRBs) are thought to result from the interaction of an extremely relativistic outflow interacting with a small amount of material surrounding the site of the explosion. Multi-wavelength observations covering the gamma-ray to radio wavebands allow investigations of this "fireball" model. On 23 January 1999 optical emission was detected while the gamma-ray burst was still underway. Here we report the results of gamma-ray, optical/infra-red, sub-mm, mm and radio observations of this burst and its afterflow, which indicate that the prompt and afterflow emissions from GRB 990123 are associated with three distinct regions in the fireball. The afterglow one day after the burst has a much lower peak frequency than those of previous bursts; this

explains the short-lived nature of the radio emission, which is not expected to reapear. We suggest that such differences reflect variations in the magnetic-field strengths in the afterglow emitting regions.
Author
Energy Distribution; Spectra; Gamma Ray Bursts; Afterglows

19990103944 NASA Marshall Space Flight Center, Huntsville, AL USA
Statistical Properties of SGR 1900+14 Bursts
Gogus, Ersin, NASA Marshall Space Flight Center, USA; Woods, Peter M., NASA Marshall Space Flight Center, USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; vanParadijs, Jan, NASA Marshall Space Flight Center, USA; Briggs, Michael S., NASA Marshall Space Flight Center, USA; Duncan, Robert C., NASA Marshall Space Flight Center, USA; Thompson, Christopher, NASA Marshall Space Flight Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

We study the statistics of soft gamma repeater (SGR) bursts, using a data base of 187 events detected with BATSE and 837 events detected with RXTE PCA, all from SGR 1900+14 during its 1998-1999 active phase. we find that the fluence or energy distribution of bursts is consistent with a power law of index 1.66, over 4 orders of magnitude. This scale-free distribution resembles the Gutenberg-Richter Law for earthquakes, and gives evidence for self-organized criticality in SGRS. The distribution of time intervals between successive bursts from SGR 1900+14 is consistent with a log-normal distribution. There is no correlation between burst intensity and the waiting times till the next burst, but there is some evidence for a correlation between burst intensity and the time elapsed since the previous burst. We also find a correlation between the duration and the energy of the bursts, but with significant scatter. In all these statistical properties, SGR bursts resemble earthquakes and solar flares more closely than they resemble any known accretion-powered or nuclear-powered phenomena. Thus our analysis lends support to the hypothesis that the energy source for SGR bursts is internal to the neutron star, and plausibly magnetic.
Author
Statistical Distributions; Gamma Ray Bursts; Research; Correlation; Normal Density Functions

19990104334 NASA Marshall Space Flight Center, Huntsville, AL USA
Chemical Processing and Analysis of 'JACEE' Circumpolar Flight 13 & 14
Fountain, Walter, NASA Marshall Space Flight Center, USA; 1997; 1p; In English; Cosmic Ray JACEE Meeting, 5-14 Dec. 1997, Hiroshima, Japan; No Copyright; Avail: Issuing Activity (NASA, Marshall Space Flight Center, Huntsville, AL); Abstract Only, Hardcopy, Microfiche

This informal presentation will address the chemical processing status, the current locations and state of data analysis (including mapping and densitometry of x-ray films, event lists and tracing of events in nuclear emulsions, etc.) of the 12 cosmic ray chambers comprising the JACEE-13 and JACEE-14 South Pole circumnavigational long duration balloon flights.
Author
Chemical Analysis; Nuclear Emulsions; Balloon Flight

19990104366 NASA Marshall Space Flight Center, Huntsville, AL USA
Observations of Gamma-Ray Bursts
Fishman, Gregory J., NASA Marshall Space Flight Center, USA; 1997; 1p; In English, 26-30 Aug. 1997, Kyoto, Japan; Copyright; Avail: Issuing Activity, Hardcopy; Abstract Only

Gamma-ray bursts remain one of the greatest mysteries in astrophysics in spite of recent observational advances and intense theoretical work. Observations of the intensity and spatial distributions of bursts have shown that their sources are not compatible with any known Galactic population of objects and many now believe that they originate from cosmological distances. This view is now reinforced by observations of optical counterparts to x-ray sources discovered by the BeppoSAX spacecraft. Recent observations of gamma-ray bursts made by the Burst and Transient Source Experiment (BATSE) a experiment on the Compton Gamma-Ray Observatory will be described. I will also describe some other work in progress and mention future directions for observations of gamma-ray bursts with BATSE/CGRO. A summary of the recent discoveries of the counterparts to gamma-ray bursts in the x-ray, optical and radio regions will be summarized along with their implications for future ground-based and space-based observations.
Author
Gamma Ray Bursts; Gamma Ray Astronomy

19990105815 NASA Marshall Space Flight Center, Huntsville, AL USA
The Fourth BATSE Gamma-Ray Burst Catalog
Paciesas W. S., NASA Marshall Space Flight Center, USA; Meegan, Charles A., NASA Marshall Space Flight Center, USA;

Pendleton, Geoffrey N., NASA Marshall Space Flight Center, USA; Briggs, Michael S., NASA Marshall Space Flight Center, USA; Kouveliotou, Chryssa, NASA Marshall Space Flight Center, USA; Koshut, Thomas M., NASA Marshall Space Flight Center, USA; Lastrade, J. P., NASA Marshall Space Flight Center, USA; McCollough, M. L., NASA Marshall Space Flight Center, USA; Brainerd, Jerome J., NASA Marshall Space Flight Center, USA; Hakkila, Jon, NASA Marshall Space Flight Center, USA; Henze, W., NASA Marshall Space Flight Center, USA; Preece, Robert D, NASA Marshall Space Flight Center, USA; [1998]; In English; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

The Burst and Transient Source Experiment (BATSE) on the Compton Gamma Ray Observatory (CGRO) has triggered on 1637 cosmic gamma-ray bursts between 1991 April 19 and 1996 August 29. These events constitute the Fourth BATSE burst catalog. The current version (4Br) has been revised from the version first circulated on CD-ROM in September 1997 (4B) to include improved locations for a subset of bursts that have been reprocessed using additional data. A significant difference from previous BATSE catalogs is the inclusion of bursts from periods when the trigger energy range differed from the nominal 50-300 keV. We present tables of the burst occurrence times, locations, peak fluxes, fluences, and durations. In general, results from previous BATSE catalogs are confirmed here with greater statistical significance.
Author
Catalogs (Publications); Gamma Ray Bursts; Gamma Rays; Position (Location)

19990106242 NASA Marshall Space Flight Center, Huntsville, AL USA

Correlation Between Radio-Millimeter and Gamma Ray Fluxes from Blazars

Ghosh, K. K., NASA Marshall Space Flight Center, USA; Ramsey, B. D., NASA Marshall Space Flight Center, USA; Sivaram, C., Indian Inst. of Astrophysics, India; 1998; In English; 193rd, 5-9 Jan. 1999, Austin, TX, USA; Sponsored by American Astronomical Society, USA; Copyright; Avail: Issuing Activity; Abstract Only, Hardcopy, Microfiche

Using multifrequency databases, we have plotted radio (5 GHz, 22 GHz, and 37 GHz) and millimeter (90 GHz and 230 GHz) fluxes versus MeV and gamma-ray fluxes of the EGRET blazar sample. Strong correlations have been found between the emissions at the radio-millimeter wavelengths and they-rays. These correlations have been explained in the frame work of Synchrotron Self-Compton (SSC) processes between the radio-millimeter synchrotron emissions and the shock-accelerated electrons in the jets of blazars. Using this SSC model we are able to explain the GeV spectra of the EGRET blazars. The present model will also explain the physics of TeV flares in blazars and the time lag between the TeV and GeV photons from a blazar.
Author

Gamma Rays; Millimeter Waves; Radio Waves; Blazars; Data Bases

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GENERAL

19990102995 Research Inst. for Advanced Computer Science, Moffett Field, CA USA

RIACS *Annual Report, 1 Oct. 1997 - 30 Sep. 1998*

Moore, Robert C., Research Inst. for Advanced Computer Science, USA; 1998; 62p; In English

Contract(s)/Grant(s): NCC2-1006; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

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Derived from text

Research Facilities; Universities; Space Missions; Space Exploration; Information Systems

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